REPORT FOR KENTUCKY RIVER BASIN

Prepared by

UNITED STATES DEPARTMENT OF AGRICULTURE
Economics and Statistics Service
Forest Service
Soil Conservation Service

In cooperation with

KENTUCKY SOIL AND WATER CONSERVATION COMMISSION
KENTUCKY DEPARTMENT FOR NATURAL RESOURCES
AND ENVIRONMENTAL PROTECTION

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KENTUCKY RIVER BASIN REPORT
on
WATER AND RELATED LAND RESOURCES
KENTUCKY

Prepared by

USDA River Basin Planning Staff
Soil Conservation Service
Economics and Statistics Service
Forest Service

In cooperation with
Commonwealth of Kentucky
Department for Natural Resources and Environmental Protection

Under Direction of
Field Advisory Committee
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PREFACE

This report presents the results of a study of water and related land resource problems and concerns in the Kentucky River Basin of east-central Kentucky. The study was conducted by the U.S. Department of Agriculture in cooperation with the Kentucky Department for Natural Resources and Environmental Protection.

The State expressed need for the study to assist decisionmakers in coordinating federal and state programs, establishing project priorities, and appraising alternatives for alleviating basic resource problems and meeting present and projected food and fiber needs. Special interest was expressed in inventorying the quantity and quality of resources available, assessing their productive potential, and identifying problems associated with resource development and use.

Authority

Authority for this study is Section 6 of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended. This act authorized the Secretary of Agriculture to cooperate with other federal, state, and local agencies in their investigations of watersheds, rivers, and other waterways to develop coordinated programs.

Participants

Principal USDA participants include the Soil Conservation Service, Economic and Statistics Service, and Forest Service. Participation of these agencies was carried out in accordance with assigned responsibilities and coordinated nationally through a Washington Advisory Committee and in Kentucky by a Field Advisory Committee.

Responsibilities

The Field Advisory Committee, composed of a chairman from the Soil Conservation Service and a member each from the Economics and Statistics Service and Forest Service, provided guidance to the river basin planning staff. The planning team, composed of a member from the three USDA agencies, utilized an interdisciplinary approach in conducting the study. Each agency staff member had responsibility for specific technical phases of study elements and participated in:

1. Collecting and assembling information from the public and state and federal agencies on the water and related land resource problems and concerns in the basin;

2. Compiling and analyzing data from other primary and secondary sources to identify physical and natural characteristics of the basin, depict economic conditions and reflect the magnitude of resource problems; and

3. Identifying and evaluating alternatives having potential for decreasing resource problems and meeting projected food and fiber needs.

The Kentucky Department for Natural Resources and Environmental Protection coordinated the State's efforts and provided major inputs. Some of the others that provided data and assistance included the Kentucky Department of Fish and Wildlife Resources; the U.S. Army Corps of Engineers, Louisville Division; the Department of Agriculture Economics, University of Kentucky; and the Northern Kentucky and Bluegrass Area Development Districts.

Report Use

Information presented in this report will provide insights on resource availability, current uses, problems, and projected needs. It will be useful to local, state, and federal agencies in planning and developing programs for resource uses and setting priorities for allocating funds to the resource development programs.

Report Organization

The main report contains a summary and three chapters--one on problems and concerns, one on alternatives, and one on implementation. The appendices include a chapter on the resource base, display of alternative plan affects and other supporting data for the three chapters and a glossary of terms.

SUMMARY

This report presents the results of the Kentucky River Basin study conducted by the U.S. Department of Agriculture in cooperation with the Kentucky Department for Natural Resources and Environmental Protection. The principal objectives of the basin study were to:

1. Identify the basic water and related land resource problems and concerns;

2. Provide information on the quantity and relative quality of the basin's natural resources;

3. Identify and evaluate alternatives for reducing soil resource problems and meeting future food and fiber production needs; and

4. Indicate opportunities and ways Federal, State, and local agencies may alleviate the basic resource problems.

Location and Description

The Kentucky River Basin is located in east-central Kentucky and is completely within the state. It contains 17 complete counties and portions of 24 others (See Plate A-4). The upstream section of the 6,966 square mile basin is in Letcher County, near the Kentucky-Virginia state line. The basin extends 175 miles downstream from its origin in the southeastern Kentucky mountainous section to the Ohio River in Carroll County.

Kentucky River, a tributary of the Ohio River, originates in Lee County about three miles east of Beattyville. It is formed by the junctions of North and Middle Forks and is joined by the South Fork at Beattyville. The Kentucky River flows in a northwesterly direction for about 260 river miles to its confluence with the Ohio River at Carrollton, Kentucky. It varies in width from a few feet in the upstream reaches to approximately 500 feet in the downstream section.

Problems and Concerns

Major water and related land resource problems and concerns identified include excessive soil erosion and sedimentation, loss of prime farmland, flooding, water supply and quality and pollution, particularly solid waste. Soil erosion, one of the major resource problems, results primarily from runoff on disturbed and unprotected row crop, surface mine and construction areas. About 55 percent of the basin's 604,000 cropland acres has an annual erosion rate in excess of acceptable soil loss limits. Sixty percent of the rural land has soil classified as having an erosion hazard.

Principal sediment sources are surface mine, roadbank, cropland, construction and development areas. The largest concentrated problem area is the Eastern Kentucky Coalfield. In this area, about 41,000 acres of orphan surface mines continue to produce sediment. The sediment contributes to problems of infertile deposition, stream channel filling, swamping or ponding, and water pollution.

Approximately 5 percent of the basin area is subject to floodwater damages. The problem prevails throughout the basin but is less frequent on the main stem and side tributaries than in the upstream reaches. Total annual damages approach $2.5 million.

Prime farmland that is used for development purposes is becoming a concern and will be more so in the future. Principal areas of concern are the Blue Grass area around Lexington and the mountainous, upper basin where prime land is scarce.

Water supply and quality problems are present in the basin. These problems are predominantly seasonal shortages, inadequate local sources, inferior quality, and inadequate facilities for storage, treatment or distribution. Surface water supplies are important to the basin since salinity and severe hardness are characteristic for groundwater supplies in several areas. Pollution problems are mostly related to surface water quality. The most noticeable pollutants are suspended sediment and sewage, industrial or mining refuse in the streams of the basin. Solid waste and debris along roadsides, in streams, and on abandoned or isolated areas were often mentioned by the public as pollution sources.

The concerns expressed regarding outdoor recreation indicate that many of the facilities and areas are inadequate or improperly located to satisfy needs. These concerns are expected to increase in the future unless additional facilities are developed for major populated areas. A shortage of fishing opportunities exists but hunting opportunities are sufficient to meet present demand at current rates of consumption.

Limited market opportunities for forest products is the major problem regarding forest. Other concerns are wildfire occurrence in the upper portion of the basin, the threat of the gypsy moth, and woodland grazing.

Alternatives

Nine alternative plans are discussed in this report. The alternative plans are directed primarily toward reducing the agricultural resource problems and meeting projected food and fiber needs for the year 2000. One alternative is formulated to indicate the conditions expected in the year 2000 in the absence of new or accelerated programs to deal with water and related land resource problems. Two alternatives emphasize economic development by utilizing the land base and related production factors to increase crop and livestock output and enhance income. The two prime farmland alternatives depict the impacts of preserving prime farmland for agricultural purposes or foregoing the use of these lands for nonagricultural uses. The environmental quality alternative provides for improving environmental conditions by accelerating conservation program measures to reduce erosion, sediment and related resource problems. Two alternatives provide information on the potential impacts of accelerating conservation and management programs or maintaining these programs at the current level. One alternative indicates the land use shifts needed and the potential impacts of removing crops from capability classes VI and VII lands.

Implementation Opportunities

Most of the alternatives and plan elements could be implemented by federal, state, and local agencies under existing authorities if funding and staffing

were sufficient. Implementation of some of the alternatives or selected components would require redirecting certain programs, emphasizing the application of erosion and sediment reduction measures and making land use shifts. The latter alternatives could be accomplished by increasing the level of planning and technical assistance, providing cost-sharing and loan assistance for farm operation and conservation measure costs, and encouraging landowners or operators to make land use adjustments.

Implementation of the prime farmland alternatives would require passage of legislation to restrict or control nonagriculture use of these lands. Greater emphasis on promoting the use of technical assistance, financial incentives and education appears to be the most feasible method to increase local participation.

PROBLEMS AND CONCERNS

(Present and Future Without Conditions)

The public and members of state and local agencies provided information on a wide range of problems and concerns in the basin. Many of the problems identified are related to the availability, use, and development of water and land resources. The other problems and concerns pertain more to the social and economic conditions. Although consideration is given to their impact on the use of water and land resources, the social and economic problems are beyond the scope of this study.

The water and related land resource problems and concerns identified by the public are the basis for this study. These problems are evaluated to reflect their relative magnitude and their potential impact upon (a) economic development, (b) production efficiency, and (c) general enhancement of the environment. Most of the emphasis is directed toward identifying and evaluating the impacts of erosion and related problems affecting agricultural output. Other considerations, such as water quality, recreation, and pollution, are addressed in lesser detail.

Problems and concerns considered in this study are shown in table I.1. This table shows the relative status of the problems and concerns and certain conditions pertinent to water and related land resources for the years of 1978 and 2000. Problems and conditions that may prevail in the year 2000 are based primarily on a continuation of present trends and without development of new or acceleration of existing water and related land resource programs and projects. The value and quantity of food and fiber projected for the year 2000 are derived from OBERS Series E' projections.[1]

AGRICULTURAL PRODUCTION

Approximately 92 percent of the 4,442,880 acre Kentucky River Basin is classed as agricultural and forest land (table I.2). This acreage is projected to decline by about 2 percent by the year 2000, as approximately 68,000 acres is expected to be converted to nonagricultural uses. Crop and pasture acreage is expected to decline by almost 99,000 acres and forest acreage to increase over 40,000 acres. Other conditions relative to the present and those expected to develop during the evaluation period are discussed briefly along with the major problems or concerns.

Agriculture is one of the principal industries in the basin. Tobacco, livestock, and corn are the dominant agricultural enterprises. Tobacco occupies the least land area, but it is the highest valued crop, approximating $130 million in 1974. The livestock industry contributed nearly $85 million in 1974, and the value of corn produced exceeded $17 million in that year.

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[1]OBERS projections are compiled by the U.S. Department of Commerce and U.S. Department of Agriculture agencies and divisions.

Table I.1--Present and Projected Conditions, Problems and Concerns
Kentucky River Basin

Item	Unit	Year 1978	Year 2000
Agricultural Production	Dollars (000)		
Major Crops		147,000	175,000
Livestock		85,000	145,000
Forest	Cu. Ft. (mil.)		
Annual Growth		64	63
Annual Removal		21	28
Erosion			
Cropland	Acres	327,370	288,000
	Tons/ac/yr	8.8	5.1
	Total Tons	2,885,500	1,468,800
Pasture[1]	Acres	777,500	585,000
	Tons/ac/yr	4.7	3.2
	Total Tons	3,656,000	1,872,000
Forest	Acres	157,055	219,600
	Total Tons	899,600	907,550
Surface Mine[2]	Acres	41,000	32,000
Sediment[3]	Tons (000)	1,204	963
Wet-Natured Soils	Acres	22,300	16,300
Prime Farmland	Acres	508,300	482,000
Floodwater Damages	Acres	200,455	198,700
	Dollars (000)	2,361	3,542
Water Supply[4]	MGD	46	69
Recreation			
Outdoor Recreation[5]	Acres	11,000	19,000
Fishing and Hunting	Day (000)	3,252	3,972

[1]Includes acreage needing erosion reduction and improved management measures.
[2]Average annual erosion rates on surface mined lands vary from less than 10 tons per acre to over 100 tons.
[3]Includes sediment from crop and pasture, forest, surface mine, and road areas.
[4]Includes key cities and towns that obtain water from the Kentucky and Red Rivers.
[5]Estimated acres currently used for outdoor recreation shown in table I.14 and projected acreage needed to meet anticipated demand for the year 2000.

Projections show that, when current prices are used, tobacco, livestock and corn should remain the major agricultural enterprises in the year 2000. The value of tobacco should approach $155 million and livestock sales about $145 million. An increasing portion of the corn produced will probably be utilized by the livestock industry. The year 2000 corn crop value will approximate $20 million.

Table I.2--Present and Projected Land Use
Kentucky River Basin

Major Land Use	Present Conditions (1978)	Projected Conditions[1] (2000)	Difference
	----------Acres----------		
Agricultural			
Cropland	603,700	544,630	-59,070
Pasture	1,110,800	1,071,310	-39,490
Forest	2,236,300	2,276,600	+40,300
Other[2]	136,020	126,390	- 9,630
Subtotal	4,086,820	4,018,930	-67,890
Nonagricultural			
Federal land & water[3]	201,900	223,900	+22,000
Urban	126,950	167,400	+40,450
Water[4]	27,210	32,650	+ 5,440
Subtotal	356,060	423,950	+67,890
TOTAL	4,442,880	4,442,880	0

[1]Projected conditions are based on a continuation of present trends and without an acceleration of existing water and related land resource programs or the implementation of new programs.
[2]Includes farmsteads, farm roads, feed lots, ditch banks, fence and hedge rows, miscellaneous farmlands, nonfarm residences, investment and industrial tracts, built-up areas smaller than 10 acres, gravel pits and borrow areas.
[3]Present conditions include 8,800 acres of water and 193,100 acres of Federal land, of which 178,780 acres are forest.
[4]Includes water areas other than Corps of Engineers Reservoirs.

Source: Soil and Water Conservation Needs Inventories for Kentucky, 1970; current Water Resource Development bulletins published by the U.S. Army Corps of Engineers; and other Soil Conservation Service and Forest Service data. Projected land use estimates were developed from study data.

Table I.4--Average annual acreage of crops (1971-1977)
Kentucky River Basin

Crop	Subarea[1]			Total
	Hills of Blue Grass	Blue Grass	Mountains and Coalfield	
	1,000's			
Corn for grain	19	49	17	85
Silage	5	14	1	20
Wheat	2	6	0	8
Barley	[2]	[2]	[2]	1
Soybeans	2	2	0	4
Tobacco	12	27	5	44
Alfalfa	14	15	[2]	29
Other Hay	48	126	16	190

[1]See table A.9 in Appendix A for counties included in subareas.
[2]Less than 1,000 acres.
Source--Average production derived from SRS Data for the period 1971-1977

The level of crop production projected for the basin for the year 2000 is shown in table I.5. These production levels, derived from OBERS E' projections, are adjusted to produce adequate roughage to meet anticipated livestock requirements. The projections are based on the assumption that the current levels of or trends for government programs, production, export and overall farm policies will continue. The data in table I.5 represent the alternative referred to throughout the report as the "Future without development" or "Future without plans."

Table I.5--Projected crop production and
acres for the year 2000
Kentucky River Basin

Crop	Production		Acres
	Units	Quantity	
		1000's	
Corn for grain	Bu.	7,681	60
Silage	Ton	424	20
Small grains	Bu.	326	7
Soybeans	Bu.	177	5
Tobacco	Lbs.	132,237	43
Hay	Ton	810	212

Source: Compiled from adjusted OBERS, Series E', projections

FORESTRY

Most concerns about forest lands are either directly related to or associated with market conditions. Pine sawtimber and top quality hardwood are the only forest products that are consistently merchantable. Outlets for pine pulpwood are sporadic, and markets for small and low quality hardwood are virtually nonexistent. These market limitations lead to an increase in inventory of growing stock as annual growth exceeds removal by a three to one margin. This situation is shown on figure I-1.

The figure also shows the anticipated demand for timber products. Data are based on the OBERS projected timber products demand for the basin. The OBERS demand is based primarily on an anticipated increase in the national production of hardwood sawtimber. Even though the projections reflect a significant increase in demand, it appears very doubtful that such requirements for basin forest products will occur. This is due largely to the basin area's poor competitive position when compared to other major hardwood regions.

Major problems related to the weak market situation for forest products include:

--Reduced opportunities and incentives for landowners and managers to practice forest management (costs exceeds benefits).
--Increased volumes and acreages of forest land stocked with unmerchantable, low quality, cull and/or decayed trees.
--An increase in the acreage of forest land in an overstocked condition.
--A trend in forest growing stock contrary to optimal stocking (annual cubic feet per acre production lags well behind land capabilities).

There are several other concerns about basin forest land. These include (1) surface mining, (2) forest fire occurrence, (3) prospects of a major insect infestation and (4) livestock grazing.

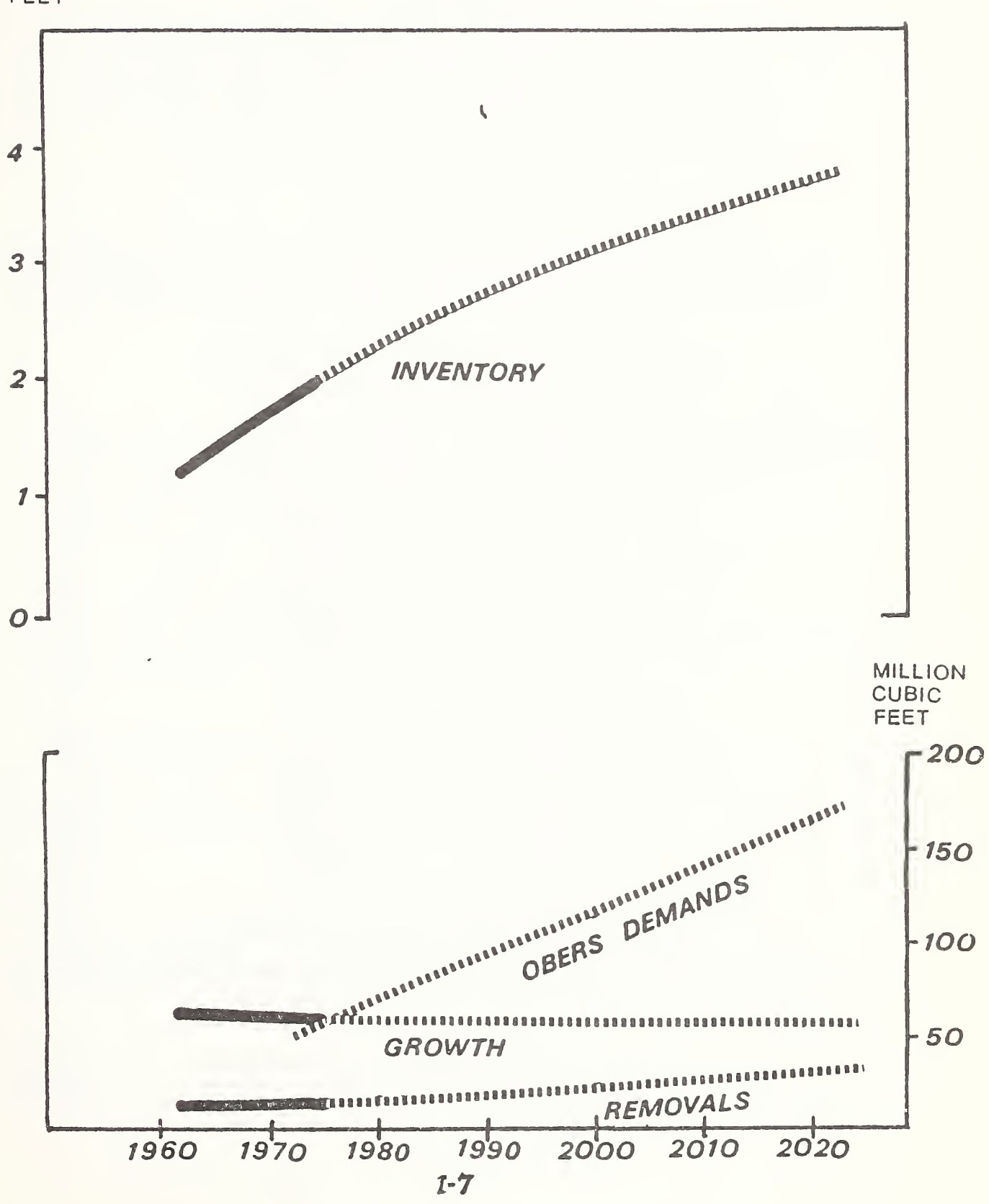
Approximately 10,000 acres of forest land is surface mined annually. The long range impacts and future utility of these lands are yet undetermined.

Seven counties in the upper portion of the basin have high or very high forest fire occurrence. It is estimated that each burned-over acre suffers a 20-percent loss in annual growth from sapling mortality. Also, many larger trees are sufficiently scarred to provide an entry-way for decay. The value of such trees is reduced considerably. Consistent with reduced market opportunities, salvage is limited. The possibility of most of the growing stock in a burned-over area becoming nonmerchantable is likely.

The southward spread of the gypsy moth poses a serious threat. While undetected in Kentucky, its arrival is considered inevitable. With a dominance of trees (oaks, hickory, maple, birches) that are preferred hosts of the gypsy moth, the impact of this defoliator is potentially severe.

Livestock grazing has a detrimental impact on approximately 121,000 acres of lands. The majority of grazed woodland (111,000 acres) is in the lower portion of the basin. In this area, growth loss, deformation and/or mortality of desirable regeneration are the prime concerns. In the upper portions of the basin, less than 0.5 percent of forest land is grazed. However, soil movement

Timber Growing Stock — Projected Trends of Inventory, Growth and Removals Kentucky River Basin



and trampling of young trees are localized concerns. The problems are most evident near streams being used for livestock water.

EROSION

Soil erosion is one of the major resource problems and concerns in the basin. The more extensive problems result from runoff on disturbed and unprotected row crop, surface mine, development, and construction areas. Sheet is the principal type of erosion, and it occurs throughout most of the area. The other types of erosion--rill, gully, streambank, and roadbank--are confined largely to steeply sloping unprotected and disturbed lands.

Cropland

Erosion occurs to some extent on most cropland. Approximately 55 percent of the basin's 604,000 acres classified as cropland has an average annual erosion rate in excess of the acceptable limits.[2] This acreage, with an estimated average annual rate of about 8.8 tons per acre, has gross erosion

Table 1.6--Cropland Acreage and Erosion Data
Kentucky River Basin

Land Capability Class and Subclass	Total Acreage	Acreage with Excessive Erosion	Average Erosion Rate
	(Acres)	(Acres)	(Tons/acres)
I	49,100	8,460	1.6
IIe	205,500	70,050	3.9
IIw	36,900	8,060	2.6
IIs	6,200	720	1.4
IIIe	133,100	100,350	10.3
IIIw	17,600	2,550	1.8
IIIs	4,200	130	1.1
IVe	75,900	64,930	15.1
IVw	2,100	140	1.6
IVs	1,200	750	1.8
VIe	47,900	47,100	22.1
VIs	5,200	5,090	16.3
VIIe	8,300	8,290	34.2
VIIs	8,800	8,810	29.8
Other	1,700	1,620	14.1
Total or average	603,700	327,050	8.8

Source--Data compiled from the 1970 Soil and Water Conservation Needs Inventory for Kentucky and updated with current crop production statistics to 1978.

[2]Because of the shallowness of most upland soils and other conditions, erosion rates exceeding 3 to 5 tons per acre are generally regarded in Kentucky as exceeding acceptable limits.

exceeding 5 million tons annually. Table I.6 shows the estimated annual erosion rates on cropland by land capability class.[3] Some erosion is on other acreage, but the dominant portion is on the acreage classified in the land classification system as having an erosion "e" hazard.

Approximately 60 percent of the basin's rural land is classed as upland erodible (e) soils. This includes 471,000 acres of cropland of which about 72 percent is in capability class and sub-class IIe and IIIe, 16 percent class IVe, and the remaining 12 percent is in classes VIe and VIIe (table I.7).

Table I.7--Land use of upland soils having erosion limitations
Kentucky River Basin

Land Capability Class and Subclass	Land Use				
	Cropland	Pasture	Forest	Other[1]	Total
	-------	----------	Acres	----------	
IIe	205,500	166,800	13,900	23,500	409,700
IIIe	133,100	207,100	38,200	19,100	397,500
IVe	75,900	177,600	37,000	12,000	302,500
VIe	47,900	284,500	254,000	7,700	594,100
VIIe	8,300	73,400	423,900	7,000	512,600
Total	470,700	909,400	767,000	69,300	2,216,400

[1]Other includes roads, farmsteads, idle, and other rural lands.

Source--Data complied from Soil and Water Conservation Needs Inventories for Kentucky, 1970, and updated with current crop production statistics to 1978.

The highest average annual rates of erosion on cropland are in the southeastern section and the Eden Shale area in the Outer Bluegrass Region of the basin. Annual erosion rates by county in these areas range from 5 to 20 tons per acre with Lee County having the highest. The Inner Bluegrass counties have the lowest average rates per acre, 4 to 8 tons.

Pastureland

Erosion is not generally a problem on properly managed and maintained pastureland. However, in the basin, erosion is a problem on approximately 275,000 acres of pasture. Most of the excessive erosion results from inadequate cover, overgrazing, improper fertilization, and related management practices. Average annual erosion rates on the inadequately managed pastureland, most of

[3]See page A-10 of Resource Base for description of Land Capability Classes and subclasses.

which is on the steep, sloping areas, are over 11 tons per acre. The average rate on the gently to moderately sloping lands is about 3.5 tons per acre per year. Annual erosion rates on the less steep and adequately managed lands are in the 1 ton per acre range.

Forest Land

Erosion on the 2,415,000 acres of forest land amounts to about 1.2 million tons annually, less than 0.5 ton per acre (table I.8). The annual erosion rates range from less than 0.1 ton per acre for some undisturbed areas to over 105 tons per acre for developed skid trails in steep terrain. Approximately three-fourths of the total erosion on forest land is from developed skid trails, log roads, and woodland grazing.

Table I.8--Estimated Annual Erosion on Forest Land
Kentucky River Basin 1978

Condition	Forest Area	Average Rate	Total	Percent of Total
	(acres)	(tons/acre)	(tons)	
Undisturbed	2,258,025	0.1	253,153	22
Grazed	120,759	2.6	312,307	27
Harvesting				
Felling, Skidding, etc.	30,616	1.4	42,456	4
Log Haul roads	2,632	95.0	223,586	19
Developed skid trails	3,048	105.0	321,448	28
Total or average	2,415,080	0.5	1,152,750	100

Source--Forest Service, U. S. Department of Agriculture.

Nonagricultural land

Erosion on nonagricultural lands occurs mainly on public roads, railroads, surface mines, commercial and industrial developments, and residential areas. Approximately 1,000 miles of roadbanks and roadbeds are affected to some degree by erosion. While distributed throughout the basin, roadbank erosion is more prevalent in Breathitt, Lee, Clay, and Letcher counties. The problems result primarily from runoff on unstabilized sloping banks, unpaved roadbeds, and unstabilized drainage ditches. Erosion on construction and development lands is severe, even though the acreage involved is not large. Estimates show that about 2,500 acres per year are disturbed, much of this having an erosion rate of 100 tons per acre or more annually.

Extensive surface mining is conducted in the southeastern section of the basin. As a result, excessive erosion is a problem on the newly disturbed and unstabilized lands. Annual erosion rates on these lands vary from less than 10

to over 100 tons per acre, depending upon the soil, slope, and degree of disturbance. Erosion on underground mining lands is confined primarily to the work and loading areas.

Problems caused by gully erosion are localized and are not as widespread and numerous as they were two or three decades past. Most of the active gully erosion is in the mountains, the Eden shale area of the Outer Bluegrass, and the steeper slopes of the lower basin. The gullies are largely on surface mined areas, idle cropland, and unimproved pasture and disturbed forest lands. Even though a substantially larger area is affected by gullies, only about 15,000 acres are considered to be a significant problem. Aside from the counties with surface mining activities, the more intensive agricultural counties affected are Garrard, Lincoln, Grant, Franklin, and Owen.

Streambank erosion and flood plain scour result primarily from high velocity floodflows. Streambank erosion consists primarily of degrading of the bottoms and eroding of the channel banks and is mostly on streams in broader alluvial valleys. Freezing and thawing, along with livestock use, contribute to the degrading bottoms and streambank problems. Flood plain scour results from floodwaters dislodging and removing surface soils on cultivated, inadequately vegetated, and disturbed lands. Most of the scour erosion damages occur on the lower sections of Red River, Elkhorn Creek, and tributaries with larger flood plain areas. Flood plain scour affects about 3,000 acres and streambank erosion about 250 miles annually.

Heavy erosion is projected to continue to be a problem in the basin, particularly in the coal mining section. Since coal is expected to remain an important energy source, both surface and underground mining are expected to continue at about the same level or even be accelerated as conversion methods are improved. Erosion on the other nonagricultural land is expected to approach the current level or decrease, if control efforts are emphasized as projected. The per acre rate of erosion on agricultural lands in the basin is projected to decrease, since more of the erodible lands currently used for crops are expected to be used for pasture and hay. Additionally, the limited agricultural activity in the mountains is expected to continue declining, but activity will accelerate in the less erodible Bluegrass section of the basin.

SEDIMENT

Sediment is a transported product of runoff induced erosion. Principal sediment sources are surface mine, roadbank, cropland, construction, and development areas. Aside from the surface mining activities in the southeastern section, the other sediment sources are distributed throughout the basin. Excessive sediment yields cause channel filling, infertile deposits on flood plains, stream pollution, and decrease in the storage capacity of water reservoirs.

The largest concentrated area with extensive sedimentation is in the coal mining section of the Eastern Coalfield Physiographic Region, especially in Breathitt, Letcher, and Knott Counties. Approximately 98,000 acres has been surface mined for coal in these and other basin counties. Over the past 10 years, an average of about 6,200 acres has been surface mined annually. Newly mined areas are critical sediment-producing sources and remain so until stabilized. Total sediment carried to the first drainage receiving site from

newly stripped areas has been estimated at about 33 tons per acre annually. In addition to sediment from the newly disturbed areas, runoff and erosion are still producing sediment from abandoned or "orphan" surface mined lands. Although some of the surface mined acreage has been stabilized, it is estimated that about 41,000 acres is still producing sediment. The annual estimated sediment yield from the coal mining area is around 500,000 tons.

The major portion of the basin's 1,000 miles of eroding road areas and the 250 miles of streambanks contributes to the sedimentation problems. The most significant roadbank erosion occurs in the southeastern counties. Roadbanks are estimated to contribute about 30,000 tons of sediment annually to the basin's streams and reservoirs.

Sediment is produced from most land used for crop production, construction, and development purposes. The most significant sediment producing cropland areas are in the more extensively agricultural counties of Garrard, Henry, Clark, and Lincoln. Construction and development activities are widespread, with the preponderance being near Lexington, Frankfort, and other larger towns.

Sedimentation of streams from basin forest lands is limited to that from skid trails, log haul roads and woodland grazing. It is estimated that sediment from log haul roads and skid trails averages 20 percent of the soil that is detached by these activities. Sediment from woodland grazing depends on the location of grazing and nearby soil trapping elements of grass, undisturbed forest, litter, etc.

The more noticeable sediment damages are infertile deposition, channel filling, swamping or ponding, and pollution. Sediment deposition damage to growing crops results from sediment laden floodwaters depositing silts or clays on crop leaves and grasses. Land damage is from deposition of coarser materials and infertile sand and gravel. Swamping or ponding results from accumulated sediment deposits in stream channels and on bottom lands that retard run-off and impede drainage. Approximately 15,000 acres in the basin are affected annually to some degree by infertile deposition and swamping. Pollution aspects of sediment are discussed briefly in the latter section of this chapter. Damages from infertile deposition, swamping, and flood plain scour were evaluated under floodwater problems and amount to about $77,000 annually.

Problems caused by excessive sedimentation in the future will be closely related to the extent of surface mining, construction, development, and agricultural activities conducted in the basin. As previously noted, these activities are expected to continue near the present level or even accelerate. Even though the potential exists for increased sediment problems, recent programs such as Rural Abandoned Mine Program (RAMP) and other actions taken under the Surface Mining and Control Act of 1977 to control the sources are expected to decrease the severity.

WET SOILS MANAGEMENT

Approximately 112,000 acres, or 3 percent, of agricultural and privately owned forest lands are classed as wet soils. As identified in the land classification system, these are soils with wetness being the dominant limitation

relative to their use for agricultural purposes. Approximately 50 percent of the wet-natured soils are used for crops, 32 percent for pasture, and 18 percent for forest and other uses (table I.9).

Soils with excess water problems result from several factors, including composition, slope, and characteristics of the soil which retard the rate of surface runoff or the infiltration of water. Ponded surface water, high water tables, and saturated soils are indications of wetness and impaired drainage. Soils with excess water problems are distributed throughout the area. Clay, Powell, Madison, Lincoln, and Owen Counties have the largest acreages.

Table I.9--Total Acreage of Class IIw, IIIw, IVw Land - 1978
Kentucky River Basin

Land Use	Land Capability Class and Subclass			Total
	IIw	IIIw	IVw	
	----------Acres----------			
Cropland	36,800	17,600	2,100	56,500
Pasture	19,100	14,100	3,100	36,300
Forest	7,100	2,800	2,000	11,900
Other	4,200	2,700	500	7,400
TOTAL	67,200	37,200	7,700	112,100

Source--Compiled from 1970 Soil and Water Conservation Needs Inventory and updated with 1978 crop production statistics.

Approximately 22,300 acres of the 56,500 acres of wet cropland soils would benefit from improved drainage systems that alleviate the excess water problems (table I.10). Most of the acreage would respond favorably to drainage, while for some it would not be feasible because of isolated location, small tract, or lack of adequate outlet. Based on past trends, improved drainage systems under on-going programs are projected to be installed on about one-third of 22,300 acres by the year 2000.

Table I.10--Cropland Acreage with Drainage Problems - 1978
Kentucky River Basin

Land Use	Land Capability Class	Subarea			Total
		Hills of Bluegrass	Bluegrass	Mountains and Coalfields	
		----------Acres----------			
Cropland	IIw	400	8,100	6,300	14,800
	IIIw	1,400	3,300	2,100	6,800
	IVw	200	200	300	700
Total		2,000	11,600	8,700	22,300

Source--Compiled from 1970 Soil and Water Conservation Needs Inventory and updated with current statistics to 1978.

Excess surface or internal water affects management and use of croplands by limiting the choice of crops to those tolerant to wet conditions, retarding plant growth, delaying land preparation and planting operations, preventing performance of timely cultivations, and restricting fall harvesting to dry periods. These limitations reduce crop yields and increase production costs, thus decreasing returns.

PRIME FARMLAND

The basin contains about 508,000 acres of potentially prime farmland. Currently about 53 percent of this land is in crops, and 42 percent is in pasture. This land represents a significant portion of the basin's current agricultural activity and agricultural potential for the future. Prime farmland includes soils in capability classes I, II, and most of IIIw.[4] It is land that is best suited for production of agricultural crops and for pastures.

Projections for the year 2000 indicate that about 98,000 acres of the basin's crop and pastureland will be converted to urban, forest and other uses. If the conversion rate for the 10-year period of 1967 through 1977 is used to project future conversions, over one-half of the 98,000 acres would come from prime farmland. Since prime farmland is generally more suitable for development purposes, the major portion of the withdrawal would be for urban expansion. The most noticeable encroachment on prime farmland is in the Bluegrass area where the city of Lexington is is expanding on the race horse and cattle farms. The present and potential loss of prime farmland represents a concern for the agricultural oriented citizens of the basin and the State of Kentucky.

Areas of concern are primarily located around metropolitan areas such as Lexington and in the Mountain and Coalfield Area where prime farmland is particularly scarce for both agricultural and nonagricultural uses.

FLOODWATER DAMAGES

Slightly over 200,000 acres, or 4.5 percent, of the basin is subject to floodwater damages (table I.11). This area includes about 197,600 acres of rural land and 2,900 acres in urban and built-up areas. Of the acreage flooding, approximately 154,000 acres are on the main stem of the Kentucky River and its tributaries. The remaining 46,500 acres are upstream from Beattyville on the North, Middle, and South Forks of the Kentucky River. (Appendix B table I.2 provides additional watershed data.)

[4]See Glossary for general definition of prime farmland.

Table I.11--Estimated Area Subject to Flooding - 1978
Kentucky River Basin

Sub-basin	Drainage Area	Area Subject to Flooding		
		Rural	Urban	Total
	----------Acres----------			
North Fork	844,150	21,465	455	21,920
Middle Fork	357,760	7,980	35	8,015
South Fork	478,720	16,480	130	16,610
Main Stem of Ky. River	2,777,570	151,635	2,275	153,910
Total	4,458,200	197,560	2,895	200,455

Source--Data developed from Soil and Water Conservation Needs Inventory for Kentucky, 1970 and from watershed investigations.

The more extensive flooding problems are caused by run-off from high intensity and/or long duration rains that inundate most of the flood plain areas. Localized, and often, severe problems result from short duration, high intensity storms, particularly in the narrow flood plain areas in the mountainous section of the basin. Floods in these steeper, sloping sections usually have higher velocity flows and are more damaging to flood plain improvements.

The frequency of flooding and the resultant damages vary throughout the basin with the more frequent floods occurring in the narrow, acclivous flood plains in the southeastern section. Although the areas flooded are not extensive, overbank flows cause severe damages because most of the agricultural and urban developments are in the valleys. The smaller and more frequent floods damage the numerous small communities and town sections that are located adjacent to the streams. Larger and less frequent floods of 10 to 20 year and greater frequency inundate these and larger developed sections in urban areas such as Hazard, Jackson, Beattyville, Whitesburg, and Neon. Appendix table I.1 shows the principal towns and communitites with flooding problems. In addition, significant damages occur to the limited but productive agricultural areas along with the highways that traverse the flood plains in the upstream basin section.

Flooding frequency on the Kentucky River and its side tributaries is considerably lower than in the upstream areas. Except for localized flooding on some of the tributaries, the probable frequency of damaging floods ranges from 20 to 50 years. Towns that have experienced severe damages from floods of these or greater frequencies are Frankfort, Irvine, Clay City, Stanton, and several smaller communities. The more serious floods occurred in 1937, 1946, 1957, 1974, 1977, and 1978. The 1978 flood, which inundated large areas of Frankfort and areas adjacent to the Kentucky River and Clay City and Stanton on the Red River, is reported to have been the most damaging.

Principal agricultural damages are to crops and pastures, fences, and farm improvements. Crop and pasture damages occur from overflows and sediment deposits that destroy plants, retard development, and prevent timely planting and harvesting operations. Flood damages to fences, roads, machinery, and related farm items are largely from "washouts" and sediment and debris deposits. The loss from flood damage results from reduced income, increased production costs and costs of repair, replacement, and restoration of damaged items. Agricultural damages from floodwater and sediment are estimated to average over $1 million annually (table I.12).

Flood damages to residential, commercial, and industrial properties occur primarily from the destructive velocity of water, depth and duration of inundation, and deposits of sediment and debris. Most of the losses are from damage to the structures and contents, and the costs required for clean-up, repairs, and replacement of damaged items.

Floodwater damages to transportation facilities are primarily from scouring, degrading, and destruction of road fills, surfaces, culverts, and bridges. These increase repair, replacement, and maintenance costs and often involve re-routing or delay of traffic. Although less widespread, similar damages occur to railroads.

Indirect damages amount to about $227,000 annually. These are damages that stem from flooding even though the property or area may not be flooded. Examples include loss in potential sales or income, traffic disruptions resulting from inundated roads or bridges, and personal inconveniences.

The recent floods on the main stem of the Kentucky, Red River, and the three upstream forks of the Kentucky have stimulated concern over the possibility of more frequent and damaging floods in the future. Although the possibility exists, floods as severe and damaging as the recent 1977 and 1978 floods are unlikely to occur frequently. However, smaller stage overbank flows are expected to occur fairly regularly in the narrow, entrenched valleys in the southeastern section. Damages from future floods are expected to increase because of the increasing value of damageable items, accelerating repair costs, and intensification of land use.

WATER

Water supply and quality problems are present in the basin, even though the average annual rainfall and runoff are about 46 and 17 inches, respectively. The problems mostly involve seasonal supply shortages, inadequate local sources, inferior quality, and inadequate facilities for storage, treatment, or distribution. As a result, several rural and urban areas have seasonal or annual shortages of quality water for domestic, industrial, or agricultural use.

Surface waters from the Kentucky River, Red River, and Lake Herrington provide most of the municipal and industrial supplies of the basin. Presently, the Kentucky River provides water to 20 cities or communities that are served by municipal systems. The Kentucky River also supplies four distilleries and two power plants with water for industrial demands. Livestock and irrigation water needs are supplied by streams and by about 23,000 acre feet of storage in farm ponds that exist in the basin.

Table I.12--Estimated Average Annual Floodwater and Sediment Damages
Kentucky River Basin

Basin and Subbasin	MAJOR DAMAGES[1]							
	Crops and Pastures	Other Agri-culture	Road and Bridge	Sediment and Erosion[2]	Urban	Other	Indirect	Total
	Dollars*							
North Fork of Kentucky River	83,925	28,100	33,900	8,370	125,600	3,650	30,000	313,545
South Fork of Kentucky River	64,445	21,600	30,600	6,430	35,900	2,800	17,700	179,475
Main Stem of Kentucky River	624,000	129,300	209,000	62,250	637,600	27,000	179,300	1,868,450
Total Basin	772,370	179,000	273,500	77,050	799,100	33,450	227,000	2,361,470

[1]Estimated damage data compiled from authorized and installed P.L. 566 watersheds in Kentucky.
[2]Includes sediment deposition and "scour erosion" on flood plains.
*Based on 1978 prices.

The quality of surface water varies in the Kentucky River and throughout the basin. In the upper reaches, the Kentucky River receives runoff from the coalfields which is high in sulfate content. As the water travels downstream, it is diluted by the South and Middle Forks to approximately one-half the previous SO_4 concentration. This causes some increase in dissolved mineral matter, a large part of which is calcium that comes from the limestone country of the central and lower basin.

Quality of groundwater in the basin is influenced primarily by calcium carbonate and hydrogen sulfide content. The freshwater in the Bluegrass and Knobs Region is "hard" as calcium carbonate is 250 to 600 parts per million. Water in the Inner and Outer Bluegrass area is considerably "softer" as the $CaCO_3$ is less than 100 ppm. In the Bluegrass region, approximately one-eighth of the wells produce water with undesirable amounts of sodium and chloride and nearly one-fifth of the wells have water with noticeable amounts of hydrogen sulfide. The main detrimental substance in groundwater from the Eastern Coalfields is sulfate from mining operations. Otherwise the well water is moderately soft with $CaCO_3$ 25 to 150 ppm.

Towns or cities obtaining most of their water supplies from the Kentucky River are Frankfort, Harrodsburg, Lawrenceburg, Lexington, Nicholasville, Richmond, Versailles, Wilmore, and Winchester. The principal industrial and municipal concerns are the shortages due to low river levels and inadequate storage facilities. Table I.13 shows the 1976 and projected water needs for the principal cities and towns in the basin.

Table I.13--Present and projected water needs by cities or towns. Kentucky River Basin

	NEEDS	
Service Area	1976	2000
	(MGD)	(MGD)
Clay City	.165	.246
Frankfort	5.000	7.694
Harrodsburg	1.500	2.513
Lancaster	.620	.666
Lawrenceburg	1.000	1.558
Lexington	29.000	41.206
Nicholasville	1.300	3.052
Owenton	.420	.619
Richmond	2.800	4.966
Stanton	.200	.310
Versailles	1.300	1.801
Wilmore	.370	.862
Winchester	2.100	3.947

Source--Water Supply Alternatives to Red River Lake, U. S. Army Corps of Engineers, Louisville District, Louisville, Kentucky.

The source of potable water for rural homes is almost exclusively cisterns and wells. Livestock and irrigation water needs are supplied mainly by streams and farm ponds, and these demands total roughly 24,500 acre-feet annually. Since this figure is nearly equal to the 22,700 acre-feet of farm pond storage that exists, the need is being met. The need for additional agricultural water is not expected to increase significantly by the year 2000. However, if the tobacco allotment should be based on acreage instead of poundage, the increase would be substantial.

POLLUTION

The public ranked various types of pollution as major concerns, particularly in the southeastern section. Most of the concerns pertained to disposal of waste materials in streams and on lands, water quality, sewage, and industrial and mining refuse. Air pollution was not regarded as a significant problem, even though air quality is affected by automobile and industrial plant emission, dust, and related pollutants.

The most frequently mentioned concern involved the dumping of solid waste material and debris along roadsides, in streams, and on abandoned or isolated areas. The magnitude of the problem is reflected by the quantity of discarded items lodged along stream banks, floating in ponds or lakes, and visible along rural roads. This problem is most prevalent in Breathitt, Lee, Perry, Leslie, and the other counties in the mountainous section. Disposition of the waste materials not only contributes to unsanitary conditions but also degrades the quality of the environment.

The most noticeable stream pollutant is suspended sediment, a product of runoff and erosion. Sediment pollution, which is reflected by excessive turbidity and concentration of suspended solids, is common on most streams during periods of high flows. Approximately 1 million tons of sediment enter the Kentucky River stream system each year. The major sediment sources are the surface mining areas, sloping cropland, and disturbed construction and development lands. In addition, the sedimentation problems are further compounded by chemical pollution from surface mining, cropland, and industrial operations.

Agricultural inputs--fertilizers, herbicides, and pesticides used in crop production--are potential polluting agents. Some of these chemicals become attached and are carried by sediment particles while others are water soluble. Data in the 1974 Census of Agriculture show that basin farmers applied about 76,200 tons of commercial fertilizers on about 181,000 acres, and utilized chemical dusts or sprays to control weeds, grasses, brush, insects or diseases on about 145,000 acres. Even though no known major problem has resulted, excessive nutrient levels from these materials have potential to alter the aquatic ecosystem, stimulate algae bloom, and cause offensive odor in reservoirs and streams.

Animal waste problems are not currently or projected to be a major problem. The swine and poultry industries are not large enough to cause concern. Since major feedlots are not prevalent, the primary potential for problems is associated with dairy and beef cattle and calves on pasture. Current levels of manure per acre of cropland and pasture average about 325 pounds per acre. Projections for 2000 indicate that the livestock industry will

increase and available land will decrease, resulting in about a 40 percent increase in animal waste per acre. This is a substantial increase over the current levels but should not be a significant problem. The projected levels are lower than current levels in many regions of the U.S. where no special difficulties have resulted.

Pollution problems from inadequate sewage disposal occur in several towns and communities and on many rural homesteads. Problems occur primarily where septic tank systems or outdoor facilities are used on impermeable, saturated, or shallow soils or have insufficient drainage fields. Problems are being magnified by the increased usage of water provided to rural areas by the water districts. Most larger towns or municipalities have primary and secondary treatment facilities, but in some cases they are of insufficient capacity and improperly operated.

RECREATION

Outdoor Recreation

Concerns expressed regarding outdoor recreation pertained mostly to the quantity and accessibility to facilities and areas. The concerns expressed indicate that, in general, many of the recreational facilities and areas are inadequate or improperly located to satisfy needs. The 1978 Kentucky Statewide Comprehensive Outdoor Recreation Plan also shows that the area is deficient in many outdoor recreational facilities.

Table I.14 shows the major land and water based recreational activities, their present supply and current and projected needs. Data in this table show that the anticipated need for 2000 exceeds the present supply for most of the activities. Some of the anticipated needs are expected to be satisfied under ongoing programs, while others involving additional water and land areas will require conversion of resources for those purposes.

Fish and Wildlife

Based on an analysis of the amount of habitat available, a shortage of fishing opportunity and a potential excess of hunting opportunity exist in the basin. The streams, ponds, small lakes, and reservoirs of the area are estimated to be capable of providing about one-half million fisherman-days of sport fishing per year. This is only one-fifth of the 2.4 million needed to satisfy present demand (table I.15).

In contrast to the shortage of fishing opportunity, there appears to be an excess of hunting opportunity. The analysis indicated that if existing habitat were producing at full capacity, more animals could be harvested than are now being legally taken. The estimated amount of opportunity that could be available now is about 2 million hunter-days which more than doubles the amount thought to be currently needed.

Table I.14--Current supply and demand for outdoor recreational items and the additional units needed to meet current and projected needs. Kentucky River Basin

Activity	Units	1978 Supply	1978 Demand	1978 Need	2000 Need
Outdoor games	Acres	512	692	180	261
Bicycling	Miles	8	347	339	377
Hiking	Miles	189	188	--	25
Tennis	Courts	275	1,079	804	930
Camping	Acres	540	823	283	418
Picnicking	Tables	3,716	6,792	3,076	4,241
Horseback Riding	Miles	130	63	--	--
Boating	Acres	8,519	12,005	3,486	5,770
Water Skiing	Acres	1,157	11,834	10,677	12,368
Sailing	Acres	299	974	676	804
Canoeing	Miles	10	32	23	27
Golf	Holes	342	980	634	814
Baseball	Diamonds	329	451	123	176
Swimming					
(pool)	100 Sq. ft.	2,245	5,209	2,974	3,574
(beach)	Acres	390	26	--	--
Basketball	Courts	239	464	225	277

Source--Statewide Comprehensive Outdoor Recreation Plan for Kentucky, prepared by the Kentucky Department of Parks, Frankfort, KY.

Table I.15--Present supply and present and projected need for fishing and hunting opportunity. Kentucky River Basin

Concern	Unit	Present Supply 1980	Present Demand 1980	Projected Demand 2000
Fishing	Fisherman-day	548,267	2,434,280	2,973,440
Hunting	Hunter-day	1,882,275	817,670	998,830

Source--Soil Conservation Service, Lexington, Kentucky.

Even though the data indicate that the habitat is capable of producing wildlife populations larger than those needed to meet present hunting demand at present rates of success, this does not mean that hunters are satisfied with those rates. It simply means that they are willing to continue to engage in hunting even though their success is minimal. Most would probably welcome a doubling of the success rates. Therefore, should improved hunting success be adopted as an objective for the basin, the gap between supply and demand would then become a concern.

ALTERNATIVE PLANS

This chapter presents nine alternative water and related land resource plans--selected for public consideration. The alternatives are formulated to reflect the interests and needs of basin residents and to be responsive to the national economic development and environmental quality objectives. All alternative plans are evaluated to reflect their projected impacts through the year 2000.

The alternative plans presented are directed primarily toward reducing the agricultural resource use problems and meeting projected food and fiber needs for the year 2000. One of the alternatives is structured to emphasize economic development, one to enhance environmental quality, and one to show the continuation of present trends. The remaining alternatives, shown in table II.1, are designed to reflect the potential impacts of different land use and management options. Table II.2 illustrates the primary and secondary problems and concerns emphasized by each alternative. All alternatives evaluated contain land treatment, stabilization, and conservation measures and are directed primarily toward reducing the erosion, sediment, drainage, and related management problems. Plan measures for reducing the magnitude of flooding, water supply, recreation and pollution problems are not addressed in detail in the alternatives but are discussed briefly in the latter part of this chapter.

Assumptions and Projections

The agricultural and nonagricultural segments of the economy in the basin have undergone significant changes in recent years. In agriculture the changes have been toward fewer but larger and more specialized farms. Nonagricultural developments have been highlighted by the increase in the number of light industrial, trade, and service establishments, particularly in the Lexington area. These and similar changes in the future will continue to have an important influence on the use of water and related land resources in the basin. Plans formulated to deal with resource problems and to assist in meeting future food and fiber requirements need to be responsive to these changes. The following narrative depicts some of the assumptions and projections used and the general conditions expected to occur in the future.

Projections indicate that mining, manufacturing, construction, wholesale and retail, utility, and service related activities will continue to expand in the basin. Most of the manufacturing and related industrial developments are expected to occur in or near the larger population centers of Lexington and Frankfort and the satellite towns around Lexington. The increases are expected to be accompanied by substantial gains in population, housing, and employment. These activities are projected to require converting about 40,000 acres of agricultural and forest land to urban uses by the year 2000.

Table II.1--Description of Alternative Plans
Kentucky River Basin

Alternative Number	Description
1.	Indicates potential future conditions without new or accelerated water and related land resource programs.
2.	Emphasizes economic development by increasing food and fiber outputs to increase income.
3.	Indicates the impacts of accelerating the livestock industry.
4.	Enhances environmental quality by reducing erosion to or below acceptable soil loss levels while maintaining the agricultural industry.
5.	Indicates the impacts of removing crops from capability classes VI and VII lands.
6.	Depicts impacts of preserving all prime farmland for crops and pasture production.
7.	Reflects the impacts of allowing nonagricultural development to occur exclusively on prime farmland.
8.	Provides information on accelerating conservation and management programs.
9.	Demonstrates the potential impacts of maintaining conservation program at the current level.

In view of the energy situation, interests in coal mining are anticipated to remain strong. As a result, surface mining activities are expected to disturb about 72,000 acres of rural crop, pasture, forest, and idle land by the year 2000. Since most of this acreage is to be reclaimed or restored to forest and pasture uses, the mined acreage will not result in a substantial loss of rural agricultural lands.

Other factors expected to influence land use will be the utilization of land area for new ponds, impoundments and other water areas. It is projected that over 5,000 additional acres will be required for these uses by the year 2000.

A diversified type of agriculture is expected to continue in the immediate future, even though shifts are anticipated toward a higher degree of specialization. Farm enlargements, reorganizations, and enterprise shifts are anticipated to facilitate the application of advanced production techniques and an increase in crop and livestock output. Tobacco is expected to remain the major cash crop, with beef as the dominant livestock enterprise. Since the basin is in one

Table II.2--Problems, Concerns, and Conditions Emphasized by Alternatives - Year 2000[1]
Kentucky River Basin

Problems - Concerns[2]	Alternatives[3]							
	2	3	4	5	6	7	8	9
Agricultural Production								
Major Crops	P_1	P_2		S_1	S_1	S_1	S_1	S_1
Livestock	P_2	P_1						
Forest Production	P_1		P_2	S_2				
Erosion								
Cropland			P_1	P_1	S_2	S_2	P_1	P_1
Pasture			P_1	P_1	S_2	S_2	P_1	P_1
Surface mine			P_1				P_1	
Sediment			S_1	S_2				
Wet-natured soils	S_1	S_2						
Prime farmlands					P_1	P_1		
Floodwater damages			S_1	S_1	S_2			
Water supply			S_1					S_2
Pollution			S_1	S_1	S_2			
Recreation			S_1	S_2			S_2	S_2

[1]This table shows the primary problems, concerns, and conditions emphasized in each alternative. The letter P indicates the primary problem(s) addressed by the alternative. The letter S indicates secondary problem(s) considered by the alternatives. The subscript number indicates the order of priority.

[2]Problems and concerns include those shown in Table I.1 of Chapter I, entitled Present and Projected Conditions, Problems and Concerns.

[3]Includes the alternatives listed in table II.1.

of the leading feeder calf producing sections of the nation, the number and average size of cow and calf operations are likely to increase. The level of forest management is projected to continue at approximately the present rate but annual growth per acre should decline slightly as it continues to exceed annual removal. Land treatment practices and their rates of application are expected to be similar to the present but with additional emphasis in urban and critical erosion areas, particularly reclamation and stabilization of surface mine areas.

Agricultural productive output in the basin should be consistent with the levels discussed in the chapter on problems and concerns. Minimum production levels were established as the basin's share of the OBERS national projections. Crop yield projections are likewise consistent with OBERS trends. The projected yields were checked for accuracy by using historical trends and normal base yields. Since most crop yields historically were lower than those for the State, the projected yields are likewise lower.

Alternative 1

This alternative is formulated to indicate the conditions expected in year 2000 in the absence of new or accelerated programs to deal with water and related land resource problems. The alternative is used as a base from which the other alternative plans are evaluated and compared. Projected conditions were developed using historical data to establish trends, with adjustments for technological and scientific advances.

Land Use and Projections

The major land use shifts anticipated without an acceleration of programs by the year 2000 are from rural agricultural land use toward nonagricultural uses. In addition to the land use changes previously discussed, other land use shifts will occur under the "without" or "ongoing" plan conditions. These shifts result in a reduction of cropland and an increase in pasture and forest. Changes in cropland, pastureland, and forest land use are reflected in table II.3 at the end of this chapter.

Plan Elements[1]

Plan elements or measures expected to be accomplished without an acceleration of existing programs by the year 2000 are shown in table II.2 and include:

1. Conservation land treatment and management measures to adequately treat about 83,000 additional acres of cropland;

2. Pasture improvement and protection measures to improve 130,000 acres;

3. Silvicultural treatment to improve growing stock on 128,000 acres of forest land;

[1]Appendix B table II.1 shows the number of plan elements for each alternative.

4. Stabilization or reclamation measures to adequately treat about 9,000 acres of previously surface mined land;

5. Stabilization and treatment measures for gully, roadbank, streambank and eroded areas;

6. Drainage measures on about 6000 acres of cropland; and

7. Installation of 755 farm ponds for livestock and irrigation water.

Impacts[2]

Application of the cropland treatment practices is expected to reduce annual erosion rates to about 5.1 tons per acre, 40 percent below the present estimated rate of 8.8 tons. A total of about 181,000 cropland acres will be adequately treated as compared to the present 141,000. Pasture improvement and management measures applied by the year 2000 will satisfactorily treat almost one-half of the total pasture acreage or about 40 percent above the current 333,200 acres. Forestry measures applied are expected to improve conditions on about 128,000 acres. Land treatment and stabilization measures expected to be applied will reduce erosion on 2000 acres affected by gullies, 200 miles of roadbanks, and 40 miles of streambanks. Newly disturbed surface mined areas are expected to be sufficiently reclaimed and stabilized under the reclamation laws applicable in the state. Work carried out under the Surface Mining and Control Act of 1977, as provided by the programs of the Office of Surface Mines, SCS, and the State, is expected to reclaim and stabilize about 9000 acres projected to be disturbed by the year 2000.

The value of agricultural products is projected to amount to nearly $300 million by the year 2000 (table II.4). Estimated costs, including crop production costs and the roughage costs for livestock feed, amount to about $135 million. Erosion on cropland and pastureland would total about 6 million tons, considerably below the current level. Sediment delivered from these lands is estimated at 360,000 tons. Approximately 26,000 man-years of on-farm employment would be required.

Alternative 2

This alternative was formulated to emphasize economic development by utilizing the land base and production factors to increase income. The economic development alternative emphasizes accelerating existing programs and initiating new programs to alleviate present and projected water and related land resource problems. Although some constraints are imposed to prevent certain land use shifts, this alternative indicates the most profitable crops and crop mixes for increasing returns. It also assists in identifying the production potential of the basin and meets the economic development objective to increase the value of the nation's output of goods and services. This alternative provides for the improvement of timber stand conditions and increases the production of desirable growing stock on forest lands.

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[2]Appendix B table II.2 shows the effects of the alternatives in actual numbers for the economic development account.

Land Use And Projections

Land use projected for alternative 2 for the year 2000 is shown in table II.3. While internal shifts between cropland, pastureland and forest land would occur, the total acreage of each would be about the same as for the without plan alternative. Additionally, the projections relative to land use and the type of agriculture expected in the future are the same for this alternative as for the without plan conditions. The major difference between the two plans is the intensity of land use, quantity of crops produced, input levels, and use of conservation and management measures.

Plan Elements

Plan elements for the economic development alternative are shown in table II.3. Most of the plan elements are the same as those for alternative 1, except this alternative would require more extensive use of conservation tillage on cropland and an increase in drainage measures. Plan elements, which are different and exceed those for the without plan conditions, are:

1. Applying conservation land treatment and management measures to adequately treat 20,000 additional acres of cropland.

2. Installing surface and/or subsurface drainage measures on almost 6,500 additional agricultural acres; and

3. Applying forest management practices to an additional 1,020,400 acres.

Impacts

The value of cash crops produced with this alternative would amount to about $194 million and livestock about $147 million. Total value of agricultural production would increase about 10 percent above the without development conditions. Production costs would increase over 8 percent to $146 million. The net increase is approximately $15 million in farm income to the basin and the creation of 2,100 man-years of additional farm employment.

Agricultural inputs needed to obtain the additional output would increase over alternative 1. This includes increases of 12 percent for chemicals, 23 percent for fuel, and 23 percent for fertilizer. On-farm development costs would increase 65 percent to $517,500 and an additional 2 man-years of technical assistance would be required.

Cropland erosion under alternative 2 would exceed the without plan conditions by almost 2 million tons. Annual erosion would increase to about 8.4 tons per acre, or 65 percent above that for alternative 1. Erosion on pastureland would increase by 552,000 tons or one-half ton greater than the projected per acre rate for the without conditions.

Acceleration of timber stand improvement practices and some reforestation of poorly stocked stands would accomplish additional desirable stocking on approximately 1 million acres. Utilization of wood for energy is expected to increase. Some basin roundwood would be used in the pulpwood and fiber or particle board industry. Also the demand for hardwood sawtimber is projected

to increase. These increased activities would promote additional improvement of timber stands and bring annual growth and removal of forest growing stock more into balance.

Controlling grazing on forest lands would enhance timber stocking. This would also reduce erosion by about 216,000 tons per year. However, increased harvesting and related activities under this alternative are expected to increase total erosion on forest land by 82 percent or 1.2 million tons per year.

Fires are a persistent problem in several of the most heavily forested counties. Reducing the annual acreage burned by 30 percent would save approximately 3 million cubic feet of forest growing stock from being either damaged or destroyed.

Alternative 3

This alternative is formulated to indicate the impacts of increasing the livestock industry, predominately beef cow and calf operations. It is designed to reflect the acreage needed for grain, roughage, and pasture to support an increase in livestock production. The alternative, even though indicating the general carrying capacity of the basin in terms of livestock numbers, is designed to be representative of viable farm operating units. It provides a basis for comparing the potential for improving agricultural returns by emphasizing expansion of the livestock industry versus an increase in both crops and livestock production under the economic development alternative. Management of forest land would be similar to alternative 1; however, woodland grazing would be recognized as a viable use of approximately 28,500 acres of forest land. This acreage is located in the Bluegrass area and is mostly in fence rows, field corners and pasture areas.

Land Use and Projections

Land use under this alternative would be similar to that for the without and the economic development alternatives. The major difference in the alternative is the type of crops produced and utilization thereof. More emphasis would be directed toward producing corn for silage, increasing the quantity of alfalfa and grass hay and improving the management of pasture acreage. The basic crop, pasture, and forest land acreage would remain essentially the same as shown in table II.3, but internal shifts between the uses would be permitted to meet pasture and roughage production requirements.

Plan Elements

Plan elements for this alternative differ from the previous two, in that pasture management and improvement are advocated. To implement the alternative would require applying improvement, protection, brush control, re-establishment, and related practices to adequately treat over 600,000 acres of pasture. This exceeds the acreage treated under the other alternatives by 480,000 acres. This plan provides for construction of 750 additional farm ponds for livestock water. Aside from increasing conservation tillage by about 30 percent over that for the without development condition, the other plan elements are the same.

Impacts

The livestock emphasized alternative would result in a gross of $310 million. The increase in production costs includes feed but excludes the acquisition of additional livestock. Consequently, net returns are not comparable to those of alternatives 1 and 2.

Erosion with this alternative would total about 7.6 million tons, slightly above the projected without conditions. The annual per acre rate on cropland would approach the 6-ton level, but the rate on pastureland would remain near the 3.5-ton level. An additional 1,000 man-years of employment would be required for this alternative over alternative 1.

Alternative 4

This alternative is formulated to enhance environmental quality, while maintaining the agricultural industry in a fashion similar to that which has been projected for without development conditions (alternative 1). The alternative provides for improving environmental conditions through reducing erosion and related natural resource problems. Plan elements included provide for accelerating the application of land treatment practices, converting cropland on steep slopes to pasture and improving wildlife habitat. Forest resource protective measures emphasized are soil stabilization, wildfire protection, and reduced woodland grazing. Provisions are included for increasing the rate of reclaiming and stabilizing critical areas.

Land Use And Projections

Land use projected for this alternative would be similar to that for the previous alternatives except for the shift of cropland to pastureland and forest land. The major shifts would involve moving crops from Land Capability Classes VI and VII lands to less steep areas and using the steeper areas for forest and pasture. These shifts are projected to involve approximately 83,000 acres currently used for row crops and hay.

Plan Elements

Plan elements selected for this alternative include those that decrease environmental problems and maintain agricultural income near the without development level. The cropland treatment practices of contouring, residue management, and zero tillage would remain essentially the same as for the without development alternative. Strip cropping and minimum tillage would increase by about 4,600 and 10,300 acres, respectively. The most significant change would involve the conversion to permanent cover of an additional 82,600 acres of cropland which is currently susceptible to erosion (table II.3).

Most pasture management and improvement practices would need to be increased to reduce erosion and sediment problems. Approximately 101,620 acres of the steeper, sloping and rocky areas would be converted to forests. An acceleration of reclamation and stabilization measures would be made to reduce critical eroding areas and sediment production.

Impacts

The estimated value of agricultural crops would approach the $300 million level, about the same as that for alternative 1. Projected production costs would amount to about $134 million. Agricultural inputs needed for this alternative would be approximately the same as those needed for alternative 1. However, the level of income for this alternative would be about one half that of alternative 1. Some 26,000 man-years of on-farm employment would be required for the alternative and approximately 4 additional man-years of technical assistance would be required to accomplish this alternative (table II.6).

Cropland erosion would be reduced to 1.3 million tons annually, or 3 tons per acre. This reduction would mean that erosion rates on cropland would be within the acceptable soil loss limits. Erosion on pastureland would be about 10 percent less than that which has been projected for the going program. Critical area treatment would reduce sediment from surface mines, gullies, and other sources by about 50,000 tons annually.

Proper drainage and vegetation of 50 percent of critical portions of the timber harvesting access system would reduce erosion by approximately 273,000 tons per year. Elimination of grazing from forest land will additionally reduce erosion by an estimated 249,000 tons annually. Details of erosion from forest land are summarized in table II.7.

Reducing the annual acreage burned by forest fires by 30 percent could reduce water yields, peak flows and subsequent flooding of small watersheds. Also, the susceptibility of several thousand acres of woodland to some accelerated erosion and sediment discharge would be diminished. Reduced smoke from woods fire will enhance air quality on a localized basis.

Alternative 5

This land use alternative was formulated to indicate the impacts of removing capability classes VI and VII lands from the agricultural cropland base. It would involve converting all class VII cropland and pastureland to forest land and all class VI cropland to pastureland. These conversions would assure that a grass or forest cover would be established on steep and sloping lands. Since the land use shifts are the major objective of this alternative, the land treatment measures and production requirements for basin lands not involved in shifts are similar to those for the without development plan.

Land Use And Projections

Implementation of this alternative would require converting about 6,100 acres of cropland and 95,500 acres of pastureland in capability class VII to forests. On the class VI lands, approximately 47,800 acres normally used for crops would be shifted into permanent pasture. The conversion of these lands to forest and pasture would decrease cropland acreage by 53,900 and pastureland by 47,700 acres. Forest acreage would increase by 101,600 acres.

Plan Elements

Plan elements for alternative 5 are shown in table II.3. These differ from the without development alternative in that about 30,000 additional acres of permanent cover would be established. Reforestation would occur on 101,600 acres. Approximately 50 percent would be natural regeneration from adjoining woodland. The balance of the acreage to be converted to forest will require some treatment. This would include 30,000 acres that could be directly planted and an additional 20,000 acres to be planted or seeded after site preparation. These land use changes and practices would be performed to assure permanent cover on all capability class VI and VII lands.

Impact

Impacts projected from implementing this alternative would be favorable when considered from the basin viewpoint. On an individual farm basis, the alternative would be less favorable, particularly if all or a major portion of the acreage was class VI and VII lands. This alternative would reduce erosion 16 percent below that of alternative 1. Acreage exceeding the acceptable soil loss tolerance would be reduced by 13 percent or 64,000 acres.

The removal of class VI and VII lands from the cropland base would require the reorganization of some farm enterprises. It would involve redistributing livestock to utilize class VI pasture and shifting crops to less sloping areas. These changes would present problems to farmers in the mountainous section where most of the land is in the steep and sloping capability classes. The problem would prevail in the lower basin section but would be less severe in the Blue Grass Region.

Agricultural income from tobacco, row crops, and livestock would be reduced in the steep, sloping areas of the basin. Most of the loss could be reduced by efficiency gained from growing crops on the more level and productive soils. The costs of redistributing livestock and reorganizing farm enterprises to utilize the pasture acreage are not considered in this alternative. As a result, agricultural income would approximate that of the without development alternative. Table II.4 shows the income and related impacts projected for the land use alternatives.

On individual sites to be converted to forest, trees planted would be correlated to soil conditions. Establishing forest cover and stabilizing sites with trees and associated vegetation is feasible, but no economic return can be predicted.

Alternative 6

This alternative provides for maintaining the highest quality of land base for agricultural purposes by preserving all prime farmland. It would require restricting nonagricultural use and development of prime farmland. All nonagricultural acreage would come from non-prime farmlands. The alternative was developed to indicate the importance of prime farmland to the basin's agricultural industry.

Land Use And Projections

Alternative 6 was evaluated by using procedures similar to those used for alternative 1. The size of the land base remained constant but the quality varied. Land use shifts are from the more erosible uplands to the level and gently rolling prime farmlands.

Plan Elements

Plan elements for this alternative are shown in table II.3 and are the same as those for the without development option.

Impacts

Impacts of this alternative are related primarily to the cost of production and quantity of erosion. If prime farmlands are preserved for agricultural use, the production costs would be about $300,000 less than for the future without plan. Since crops could be shifted from more erosible soils to prime farmland, erosion would be reduced by 50,000 tons (table II.5).

When prime farmland is saved, another benefit is the increased capacity for future agriculture production. A 3 percent increase in income is possible when basin capacity is approached. This is reflected in the analysis as idle capacity between the alternative land assumptions. Over 62,000 additional acres of land is idle in the "prime land saved" analysis when both land bases are required to produce the same output levels.

Alternative 7

This alternative is formulated to reflect the impacts of permitting prime farmland to be used for nonagricultural purposes. It is opposite from alternative 6 and indicates impacts of shifting crop production to non-prime lands.

Land Use And Projections

The evaluation procedures used for the prime farmland alternative are used for this option. The quality of the land base varies but the land base is held constant. Land use shifts are from prime lands to non-prime lands.

Plan Elements

The plan elements used for this alternative are the same as for alternative 1, the without development alternative (table II.3).

Impacts

If nonagricultural developments occurred on prime farmland, production costs would increase by $700,000 over the without conditions and $1 million over alternative 6. Erosion would increase by about 90,000 tons on cropland and 900,000 tons on pastureland. Total erosion would exceed that of alternative 6 by 20 percent. Although these two alternatives (6 and 7) are the extreme possibilities, they illustrate some of the potential consequences of foregoing the use of prime farmland.

Alternative 8

Alternative 8 was constructed to provide information on an acceleration of conservation and management programs. It indicates the potential impact of accelerating the rate of applying conservation program measures and the increase in the level of technical assistance needed for the accelerated program.

An evaluation of this alternative requires some basic assumptions and considerations. Foremost, it should be recognized that about 33 man-years of technical assistance are presently required to maintain the level of conservation work currently being performed in the basin. It is assumed that a similar level of staffing will be maintained and that the time required for planning and applying conservation measures in the future will be similar to the present. In using these general assumptions, about 3 additional man-years of technical assistance would be needed to carry out the increased level of conservation program measures projected for future without development alternative for the year 2000. The addition of 3 man-years of technical assistance to the 33 man-years currently needed for the present on-going program brings the level to 36 man-years of technical assistance for alternative 1, the projected without development alternative for the year 2000. The level of conservation program measures to be applied under this alternative would be increased about 10 percent above the level for alternative 1.

Land Use and Projections

Land use projected for this alternative would be similar to alternative 1 except for the shift of about 15,000 acres of cropland to pastureland. The increased level of conservation measures applied under this alternative would enable farmers to use fewer cropland acres to attain the output level of alternative 1.

Plan Elements

Alternative 8 would require accelerating the application of all plan elements included for alternative 1 except those applicable to forest, drainage, and certain critical areas. The level of the conservation measures applied would be the same as for the without development alternative (table II.3)

Impacts

Implementation of this alternative would increase the level of conservation program measures applied by about 10 percent. The increased level would increase production costs slightly but decrease cropland and pastureland erosion by about 10 and 5 percent, respectively. The alternative would require 39 man-years of technical assistance, or 3 man-years above the 36 man-years require for the without development alternative - alternative 1.

Alternative 9

This alternative was formulated as a comparison to alternative 8. It provides information on the potential impacts of decreasing the level of technical assistance by 10 percent below that projected to be required for alternative 1.

Land Use and Projections

Approximately 24,000 acres of pastureland would be converted to cropland under this alternative. This additional cropland acreage would be needed to attain the production output level of the without development alternative.

Plan Elements

Plan elements for this option are the same as for alternative 8 and essentially the same as alternative 1. However, the quantity applied is substantially below that of the other alternatives.

Impacts

The level of technical assistance for this alternative has been decreased by 10 percent below the 36 man-year level projected for the without development alternative for the year 2000. A 10 percent reduction from the 36 man-year level would result in a loss of 3 to 4 man-years of technical assistance. This reduction would mean that 33 man-years of technical assistance would be available to perform conservation activities under this alternative. This amount of assistance could not maintain the level of conservation work being performed and would meet only 83 percent of the projected without development needs for the year 2000.

The effects of decreasing technical assistance would be reflected in a reduction of accomplishments and in the degree of erosion and related problems. For example, when the number of conservation measures applied is directly related to the amount of technical assistance available, the effects of the assistance may be expressed as a reduction of the problems or as gains made thereby. When considered from this viewpoint, a 10 percent reduction in programs would result in a 30 percent increase in annual erosion on cropland over the projected "without development" for the year 2000. The value of agricultural production for this alternative would be equivalent to that for alternative 1, the without development option. Since the level of conservation applied would decrease, production costs for this alternative would decrease slightly. Tables II.4, II.5, and II.6 show the estimated impacts for alternative 9.

Other Alternatives and Plan Elements

The alternatives and plan elements presented are concerned mostly with alleviating erosion, sediment, and water quality problems. Other alternatives and plan elements identified, but not evaluated in the alternative section, included those having potential for dealing with flooding, water supply, and other resource problems and concerns identified in Chapter I. The remainder of this section is directed toward identifying potentials for reducing or preventing the identified problems.

Floodwater Damages

Potential for preventing or reducing floodwater damages in the basin is through applying land treatment, structural or nonstructural measures, or a

combination of these measures. Structural measures may include floodwater retarding structures, dikes, levees, channel improvements, and floodproofing, either singly or in combination. Nonstructural measures applicable are flood alarm systems, flood insurance programs, and flood plain zoning.

Flood insurance programs and flood plain zoning systems offer potential for obtaining financial assistance to offset floodwater losses and preventing floodwater damages in some upstream communities identified in Chapter I. Flood alarm systems to provide advance warning and the projected flood stages, particularly for communities located adjacent to Kentucky River, would permit evacuation of the area ahead of floods.

Potential for reducing floodwater damages by projects installed for purposes other than flood protection is significant although not usually recognized. For example, most impoundments with municipal, fish and wildlife, agricultural, or recreational water supplies provide some flood protection.

Water Supply Potential

Potential for installing upstream reservoirs and impoundments to obtain additional water supplies is good in most of the basin. However, suitable sites are limited in part of the central portion, which is a limestone area and has low relief. Sites having adequate storage characteristics are found in all subbasins, but most are in the upstream tributaries.

In addition to the upstream reservoirs, potential exists for constructing on-farm impoundments for livestock water, fish and wildlife, recreation, flood prevention, and grade stabilization purposes. No attempt was made to locate, identify the number, or estimate the storage available in the potential sites.

Recreational Development Potential

Potential exists for development of outdoor recreational facilities and areas needed to satisfy present and projected needs. The recreational facility or area needs may be fulfilled through acquiring land needed for constructing playground facilities; converting unused rural or urban lands to recreational areas; developing additional water and waterbased facilities; and encouraging individuals to transfer land and related resources to recreational uses. In the surface mining area, potential exists for developing and using the "orphan lands" for hiking trails, horseback riding, hunting, bicycling, golfing, and similar recreational activities. Opportunities for increasing fish resources to satisfy projected needs are through developing additional water areas and intensively managing existing waters. The latter would require rehabilitation of streams and reservoirs that are adversely affected by pollution. Addition of new water areas could be attained through the development of appropriately distributed lakes to support fish populations. Potential for developing additional hunting areas and wildlife habitat are through acquiring lands, encouraging landowners to improve habitat, and managing existing areas to support larger game populations.

Pollution Abatement Potential

Opportunities exist throughout the basin for individual and group effort to prevent and reduce pollution. Some opportunities for pollution abatement include decreasing the quantity of debris and solid waste material deposited along roadsides, in streams, and on rural lands; preventing discharge of excessive sewage, animal waste, and industrial effluents into streams; applying erosion control and sediment reduction measures on lands susceptible to erosion; and reducing the practice of burning debris and waste materials that contribute to air pollution. Major efforts required to reduce air, water, and land pollution will involve installing improved sewage disposal systems, modifying manufacturing practices to prevent discharging effluents into streams, and making other agricultural and nonagricultural changes to minimize pollution. Most of the other efforts will only require individuals and groups to discontinue disposing waste products in streams or on rural lands and curtailing similar practices which contribute to pollution.

Table II.3--Summary of Plan Elements and Land Use by Alternatives - Year 2000
KENTUCKY RIVER BASIN

Plan Elements[1]	Units	Alternatives 1	2	3	4	5	6	7	8	9
LAND TREATMENT										
Cropland										
Contouring	Acres	8,460							+ 6,040	- 6,879
Stripcropping	Acres	12,120			+ 4,600				+ 8,980	- 11,290
Residue Management	Acres	18,320							+ 2,180	- 16,388
Minimum Tillage	Acres	16,860	+ 9,080	+ 6,428	+ 10,303	- 948			+ 3,632	+ 3,563
No Tillage	Acres	12,698	+ 10,252	+ 1,796	- 86	38			+ 10,742	- 7,574
Permanent Cover	Acres	23,650			+ 82,614	+ 30,240			+ 14,720	- 23,650
Pasture										
Management Improvement	Acres	124,800		+480,295	+311,931				+124,800	-124,800
Change in Land use	Acres	5,680			+ 49,488	+ 49,488			+ 31,200	- 5,680
Forest										
Timber Stand Improvement	Acres	56,800	+889,200							
Reforestation	Acres	71,200	+131,200		+ 50,000	+ 50,000				
Critical Area Stabilization										
Gully	Acres	2,240								
Streambank	Miles	40			+ 40				+ 40	
Roadbank	Miles	200			+ 200				+ 200	
Surface Mines (old)	Acres	9,000			+ 9,000				+ 9,000	
Surface Mines (new)	Acres	72,000								
Drainage (Wet soils)										
Agricultural Land	Acres	6,076	+ 6,402	+ 5,132	+ 235	+ 2,488				- 6,076
Farm Ponds	Number	755		+ 745						
Surface Area	Acres	2,300		+ 2,200						
LAND USE										
Cropland	Acres	544,630			- 82,614	- 30,240			- 14,720	+ 23,650
Pasture	Acres	1,071,310			- 19,006	-71,380			+ 14,720	- 23,650
Nonfederal Forest	Acres	2,276,600			+101,620	+101,620				

[1]Plan elements for alternatives 2 through 9 are shown as the same as, greater than or less than those for Alternative 1. A blank or -- indicates the alternative or item is the same as that for alternative 1 or was not evaluted. This is true for table II.4, II.5, and II.6.

Table II.4--Summary of Alternative Plan Effects - Year 2000
KENTUCKY RIVER BASIN

Accounts and Impacts	Units	Alternative Plans 1	2	3	4	5	6	7	8	9
		1,000 Units								
ECONOMIC DEVELOPMENT ACCOUNT										
Value - Agric Products										
Cash crops	dollars	175,756.8	+ 18,422.8	+ 3,690.8	- 516.					
Roughage crop	dollars	115,616.1	+ 2,575.6	+ 9,451.1						
Value of forest products	dollars	5,900.	+ 8,000.	- 100.	+ 200.	+ 200.				
TOTAL VALUE		297,272.9	+ 28,998.4	+ 13,041.9	- 316.					
Value of Livestock Product	dollars[1]	144,502.2	+ 2,911.1	+ 26,183.7						
COSTS										
Cash crop production	dollars	104,305.8	+ 8,432.3	+ 1,250.1	- 1,313.1	- 382.6	- 141.	+ 55.1	+ 413.2	- 85.5
Roughage costs	dollars	29,907.9	+ 2,272.6	+ 3,932.6	- 548.7	- 108.9	- 167.9	+ 650.8	- 530.6	- 561.5
Forest products										
Region	dollars	155.9	+ 1,146.9		+ 636.7	+ 104.2				
Rest of nation	dollars	467.5	+ 3,440.9		+ 1,910.3	+ 312.8				
Other										
Region	dollars	315.	+ 202.5	+ 162.4	+ 436.2	+ 235.7	+ 727.6	- 148.6	+ 727.6	
Rest of nation	dollars	666.	+ 37.	+ 92.5	+ 74.	+ 18.5			+ 55.5	- 55.5
TOTAL COSTS										
Region	dollars	134,684.6	+ 12,054.3	+ 5,345.1	- 788.9	- 151.6	- 308.9	+ 705.9	+ 610.2	- 795.6
Rest of nation	dollars	1,133.5	+ 3,477.9	+ 92.5	+ 1,984.3	+ 331.3			+ 55.5	- 55.5
NET EFFECTS	DOLLARS	161,454.8	+ 13,466.2	+ 7,604.3	- 1,511.4	+ 20.3	- 308.9	- 705.9	- 665.7	+ 851.1

[1]Value of livestock products shown but excluded from the total value of products produced.

Table II.5--Summary of Plan Effects by Alternatives - Year 2000
KENTUCKY RIVER BASIN

Accounts and Impacts	Units	Alternatives 1	2	3	4	5	6	7	8	9
		1,000 Units								
ENVIRONMENTAL QUALITY ACCOUNT										
Gross Erosion										
Cropland	Tons	2,559.4	+ 1,997.	+ 389.2	- 1,239.	- 298.4	- 47.5	+ 87.8	- 259.1	+ 746.9
Pasture	Tons	3,467.2	+ 552.	- 21.3	- 377.4	- 610.1	- 132.	+ 887.7	- 189.5	+ 196.5
Forest	Tons	1,160.4	+ 1,208.1		- 357.4	+ 101.6				
TOTAL	Tons	7,187.	+ 3,757.1	+ 367.9	- 1,973.8	- 806.9	- 179.5	+ 975.5	- 348.6	+ 943.4
Land Exceeding "T"										
Cropland	Acres	185.1	+ 75.7	+ 15.4	- 185.1	- 14.7	- .5	+ .8	- 46.3	+ 62.2
Pasture	Acres	310.1	- 205.2	- 310.1	- 49.5	- 5.6	+ 15.9	- 94.8	+ 69.3	
Critical Areas										
Surface Mine										
Active	Tons	434.								
Nonactive	Tons	501.			- 141.				- 141.	
Other	Tons	181.			- 10.7				- 10.7	
Agricultural Inputs										
Chemicals	Dollars[1]	5,944.3	+ 700.9	+ 488.7	- 101.9	+ 15.4	- 64.2	+ 117.1	+ 264.1	- 214.4
Fertilizer										
Nitrogen	Tons	12.8	+ 3.9	+ .5	+ .2					
Phosphorus	Tons	23.5	+ 5.6	+ 5.8		+ .9	- .5	+ .9	- .1	- .3
Potassium	Tons	28.8	+ 5.7	+ 4.1	+ .2	+ .9	- .5	+ 1.	- .1	- .3
Fuel	Gallons	4,937.8	+ 1,106.5	+ 663.	- 171.7	- 22.7	- 41.7	+ 94.8	- 81.	- 43.4
Sediment Yield										
Forest	Tons	174.1	+ 136.		- 53.7	+ 15.2				
Surface Mines										
Active	Tons	204.								
Nonactive	Tons	165.			- 46.4				- 46.4	
Other	Tons	61.			- 3.6				-3.6	
Crops & Pasture	Tons	358.6	+ 149.9	+ 21.9	- 95.7	- 54.1	- 10.7	+ 58.	- 26.7	+ 56.1

Table II.6--Summary of Plans Effects by Alternative - Year 2000
KENTUCKY RIVER BASIN

Accounts and Impacts	Units	Alternatives 1	2	3	4	5	6	7	8	9
		Actual Units								
SOCIAL WELLBEING ACCOUNT										
Employment										
On-farm	man-years	26,413	+ 2,074	+ 976	- 48					
Technical assistance	man-years	36	+ 2	+ 5	+ 4	+ 1			+ 3	- 3
Recreation										
Additional Water	acres	2,300		+ 2,200						- 2,300
Improved Habitat	acres	29,000			+132,100	+ 79,700			+ 45,900	- 29,000

[1]This value is also included in the cost of production in the NED account

Table II.7--Forest Lands Erosion Summary - Year 2000
Kentucky River Basin

Forest Condition	Alternative 1		Alternative 4	
	Acres	Tons/Yr.	Acres	Tons/Yr.
Undisturbed Forest	2,257,779	252,871	2,339,835	298,562
Grazed Forest	129,313	328,655	41,924	79,656
Timber Harvesting	36,026	587,290	33,321	315,077
Steep Land Converted by Plan	0	0	101,620	101,620
Steep Land Naturally Reclaimed to Forest	54,562	6,924	62,300	7,949
Totals	2,477,380	1,175,740	2,579,000	802,864

Source: U.S. Forest Service.

OPPORTUNITIES FOR IMPLEMENTATION

Implementation of programs for developing and using the basin's water and related land resources should be coordinated by community, city, county, area, state, and federal entities. The leadership for coordinating and implementing the alternatives or selected components should be provided by state and federal agencies. The Kentucky Department for Natural Resources and Environmental Protection and the Soil Conservation Service of the U.S. Department of Agriculture must assume the major responsibility for implementing the plan elements dealing with land treatment and erosion reduction.

The previous chapter identified nine alternatives. These alternatives vary primarily in the quantity of practices applied to achieve protection, preservation and development of water and related land resources in the basin. All alternatives, except the two for prime farmland, require different levels of conservation and management practices. Primary inputs needed for implementation of the practices are technical aid, financial incentives, and information to landowners and operators.

The prime farmland alternatives differ from the others in that the most probable means of preserving prime farmland is through the passage of State legislation or by local zoning limits on development. Some states have effectively utilized tax incentives, which requires legislation, to accomplish preservation of prime agricultural land.

FEDERAL AGENCIES

The principal U.S. Department of Agriculture agencies having responsibility for administering programs and providing services to promote conservation, development, and utilization of water and related land resources are the Soil Conservation Service, the Cooperative Extension Service, Agricultural Stabilization and Conservation Service, and Farmers Home Administration. The U.S. Forest Service provides financial and technical assistance on forested lands.

Soil Conservation Service

The Soil Conservation Service (SCS) has authority from several legislative actions. Under PL 74-46, the SCS has a broad program of soil and water conservation and development. Their principal function is to assist landowners and operators in the planning of land use and the installation of land treatment measures. Under PL 83-566, the SCS provides technical and financial assistance to state and local organizations for watershed protection, flood prevention, fish and wildlife enhancement, public recreation, irrigation and drainage. Loan assistance is also available for constructing municipal and industrial water supply reservoirs. To date, one watershed project has been completed and three are in the process of being installed or have been approved for installation (plate III-1).

Resource Conservation and Development projects authorized under PL 87-703 are to assist conservation districts, local government or individuals to

improve economic, environmental or social conditions in their communities in multicounty areas. For accelerated conservation or land use change activities, the SCS can provide technical and financial assistance to eligible sponsors.

Title IV of Public Law 95-87 established funds and programs for the reclamation of abandoned mines. The SCS is responsible for the Rural Abandoned Mine Program phase of the law. Under this program, the SCS, through conservation districts, provides long-term federal technical and financial assistance to land users for the reclamation, conservation, and development of certain abandoned coal-mined lands. More specifically, the program's objectives are to (1) stabilize mined lands, (2) control erosion and sediment on mined areas and areas affected by mining, (3) reclaim lands and water for useful purposes and (4) enhance water quality or quantity where it has been disturbed by past coal mining practices.

In addition to these authorities, the SCS provides information and data on soil, land use and the magnitude of problems within a region. The SCS Soil Survey and Inventory and Monitoring Programs have historical and current data available upon request from State and local offices.

Cooperative Extension Service

The Cooperative Extension Service of the USDA Science and Education Administration is the education agency of USDA and the land grant universities. The Extension Service provides information relating to conservation programs and practices through their local office network or via specialists located at land grant universities.

Agricultural Stabilization and Conservation Service

The Agricultural Stabilization and Conservation Service (ASCS) administers production adjustment, resource protection and farm income stabilization programs. Under authority of PL 74-76, the ASCS provides cost sharing for a wide variety of soil, water, forestry and related conservation and/or pollution abatement practices. The ASCS also administers the Forest Incentive, PL 91-524, under which cost sharing is provided for forest practices; the Water Bank Act, PL 91-559 which applies to the management of wetlands; and PL 95-240 and PL 85-58 under which cost sharing can be provided for agriculture damages or losses caused by natural disasters.

Farmers Home Administration

This agency, under authority of PL 92-219, as amended, makes loans and grants to qualified recipients. Loans are available for farm ownership and operations, emergencies, recreational enterprises and grazing associations. Loans are also available to small communities for water and waste disposal systems. In addition to financial aid, the Farmer's Home provides technical and management assistance.

Forest Service

The Forest Service (FS) is divided into three principal branches: the National Forest System, State and Private Forestry, and Forest Research. All three of these are represented in the basin.

1 Completed Projects, June 1980

PROJ. NO.	WATERSHED IDENTIFICATION	ACRES	STRUCTURAL MEASURES: RESERVOIRS: FLOOD-WATER RET.	RESERVOIRS: MULTI-PURPOSE	RESERVOIRS: OTHER	CHANNEL MODIF (MILES)	TOTAL COST ($000): FED	TOTAL COST ($000): LOCAL	YEAR COMP LETED
3	Red River 1/	16,000			1	6	353	206	1960

2. Projects Being Installed, June 1980

PROJ NO	WATERSHED IDENTIFICATION	ACRES	STRUCTURAL MEASURES: RESERVOIRS: FLOODWATER DETENTION: P	FLOODWATER DETENTION: C	MULTI-PURPOSE: P	MULTI-PURPOSE: C	OTHER: P	OTHER: C	CHANNEL MODIF. (MILES): P	CHANNEL MODIF. (MILES): C	ESTIMATED COST ($ 000): FED.	ESTIMATED COST ($ 000): OTHER
35	Red Lick Creek	45,000	4	1	1	1					739	702
38	Chamberlain Branch	334	1								195	23

1/ Pilot project installed under Public Law 46.

WATERSHED IDENTIFICATION

COMPLETED
3 RED RIVER 1/

OPERATIONS
35 RED LICK CREEK
38 CHAMBERLAIN BRANCH

APPLICATIONS
X HANGING FORK CREEK

VICINITY MAP

PLATE III - 1
WATERSHED STATUS
As of June 1980
KENTUCKY RIVER BASIN
KENTUCKY

0 10 20 30
APPROXIMATE SCALE - MILES

0 10 20 30 40
APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM 1:250,000 U. S. G. S. QUADRANGLE SHEETS, TRANSVERSE MERCATOR PROJECTION.

SOURCE Data compiled by River Basin Planning Staff.

AUGUST 1980 4-R-37503

USDA-SCS-FORT WORTH, TEXAS 1980

AUGUST 1980 BASE 4-R-34039-2

Under provisions of the Organic Administration Act of 1897 and PL 86-517, Congress established that the renewable surface resources of the National Forests (primarily outdoor recreation, forage, timber, water, wildlife and fish habitat) shall be administered for multiple use and sustained yield. Within the framework of this legislation and dependent upon funds available, reforestation, timber stand improvement, forest fire management and a variety of other resources protection and management activities are implemented. In 1976, PL 85-233 reaffirmed the principles of multiple use and sustained yield. The new act provides directives for planning, guidelines for timber harvesting, provisions for public involvement, and other aspects of National Forest System management.

State and private forestry functions are conducted under PL 95-313. This arm of the Forest Service has responsibility for providing national leadership, technical and financial assistance to resource managers and operators of nonfederal forest lands. Southeastern Area State and Private Forestry, with the Kentucky Division of Forestry, provides leadership in the protection and management of Kentucky's privately owned non-industrial forest lands. Cooperative forestry programs, administered through the above authority, include management planning, timber production, insect and disease control, control of rural fires, improvement and maintenance of fish and wildlife habitat, and urban forestry assistance. Forest industries may receive assistance in forest products utilization, marketing, and management.

The Forest and Rangeland Renewable Research Act, PL 95-307, provides a broad charter for research in forest and renewable resources. Work being conducted in the basin includes inventories and assessments of forest resources, surface mine reclamation, and forest watershed management research.

Other Federal Agencies

Various other federal agencies have authority under numerous acts to contribute to the conservation and development of the basin's resources. Some of these are:

1. Department of Army - Corps of Engineers
2. Department of Housing and Urban Development - Federal Emergency Management Agency
3. Department of Interior - Heritage Conservation and Recreation Service
4. Department of Interior - Fish and Wildlife Service
5. Department of Interior - Geological Survey
6. Environmental Protection Agency

STATE AGENCIES AND PROGRAMS

The Commonwealth of Kentucky sponsors and administers several projects and programs influencing the development and use of water and related land resources.

Kentucky Department for Natural Resources and Environmental Protection

Major activities of this department are designed to conserve natural resources and protect environmental conditions. Some activities of this department are carried out by:

Division of Conservation - This division assists Kentucky's 121 conservation districts and active Watershed Conservancy Districts with planning and implementing conservation programs. It also provides administrative, financial, educational, and informational services to the Districts to assist in getting sound, long-term conservation practices applied on the land. The Division has soil scientists that cooperate with the Soil Conservation Service, U.S.D.A., and the University of Kentucky in the Soil Survey program.

Division of Forestry - The major responsibility of this division is providing services and carrying out programs to protect, and improve forest resources. District personnel are assigned throughout the basin area and assist landowners with timber stand improvement, timber marking, and reforestation practices, including trees for planting. They also develop management plans, prevent and suppress forest fires, provide assistance in utilizing and marketing forest products, and provide guidance for forest activity related erosion control practices.

Division of Water - This division is concerned primarily with assisting local groups and agencies with planning and installing measures to control or reduce sediment, pollution, and related water problems. It provides assistance to agencies and groups interested in developing municipal and industrial or recreational water supplies in the basin.

Division of Abandoned Mines - The development and application of land use management plans to reduce sediment, runoff, and pollution problems on abandoned mine areas are some of this division's responsibilities. It is also concerned with identifying and developing abandoned mine areas for recreational and other beneficial uses, and encourages research and demonstration programs to advance these purposes.

Kentucky Department of Parks

The chief function of this department is planning, developing, and administering the park system for the State. In addition, the Department administers the Land and Water Conservation Act and is responsible for Kentucky's outdoor recreation planning.

Kentucky Department of Fish and Wildlife Resources

Major activities of this department include conducting inventories and investigations to facilitate identifying fish and wildlife populations; evaluating habitat conditions; managing state and other publicly owned or controlled lands and waters for fish and wildlife production; introducing new species to the State lands or waters; and stocking suitable lands and waters with native species. The department also performs analyses and studies on water quality in lakes and streams, fish and wildlife species life histories, and the effectiveness of management techniques.

LOCAL AGENCIES AND PROGRAMS

Area Development Districts

These districts were formed to assist cities, counties and regions in comprehensive planning and development activities. Of the area development districts in Kentucky, parts of six are in basin area (plate III-2).

COUNTY AND LOCAL ORGANIZATIONS AND PROGRAMS

Soil and Water Conservation Districts

All basin counties have soil and water conservation districts. These locally organized districts are entities of state government and provide assistance and guidance for resource planning and development. In addition, the districts have authority to condemn land for flood control and related purposes, initiate and request land taxation action and provide certain land use regulations. Most of the districts' activities are associated with planning and assisting land users and local units of government in the conservation and proper management of soil, water and related natural resources. The local districts' programs are carried out with technical assistance provided by the Soil Conservation Service.

Other Local Groups

Several county and local organizations and groups conduct activities and carry out programs affecting water and related land resources. Some of these include county, city, or local governments, educational boards, schools, and planning and zoning commissions. Others are religious, financial, business, recreational, agricultural organizations or institutions, and related men's and women's clubs.

Although varying by location, the above organizations conduct and sponsor a variety of activities and programs directly or indirectly associated with natural resources.

TECHNICAL ASSISTANCE FOR IMPLEMENTATION

The previous discussion identifies agencies and organizations that should provide leadership for basin conservation and development activities. This discussion and the brief description of the alternatives in Chapter II indicate the general direction and nature of efforts that would be required to implement most aspects of the alternatives. The discussion, however, does not identify the more feasible conservation and management practices for reducing erosion problems by land capability classes. The remainder of this chapter is directed toward indicating some of the conservation practices and systems that appear more suitable for different land capability classes.

This section is organized by land capability class and subclass. Emphasis is directed mainly to the subclass (e) soils on which erosion is the dominant limitation or hazard that affects use. The analysis is structured to indicate the most appropriate conservation practices to use for row crop production and when necessary the combination of crop rotations and physical practices to achieve soil loss tolerance levels. Information is also provided on the estimated

cost of the practices, the relative impact on adjusted farm returns, and the range in annual erosion rates expected with different cropping systems and/or rotations. Table III.1 contains data showing the relative erosion rates for the cropping systems by land capability classes and subclasses.

Class I Soils

Soils in land capability class I, such as Huntington, Cuba, Armour, Maury, and Shelbyville, generally do not have significant erosion problems. The soil loss tolerance levels range from 3 to 5 tons per acre on most class I land. Although erosion rates may exceed the tolerance level on some class I soils under certain conditions, the rates can be reduced to acceptable tolerance limits by using residue management or reduced tillage methods. It should be emphasized, however, that careful management is important on all soils, including those with historically small erosion problems to avoid depletion and to maintain a high level of productivity.

Classes II, III, and IV

Soils in these land capability classes are the ones used for crops in most of the basin's agricultural areas. These also represent the area where the most significant impact can be made on the cropland soil erosion problems. Recommendations to control erosion on cropland soils must be chosen based on several considerations. For example, the option of using appropriate cropping systems reduces the necessity of physical practices such as contouring or stripcropping. However, the adopted cropping system may require changing tillage methods and farm equipment. The choice of conservation methods to reduce erosion thus depends on the farming enterprise, crops produced, technical assistance available, preference, and economics, particularly available capital for different farm equipment. The following conservation cropping systems and practices, which are presented by land capability class, indicate some of the options available.

Class II Soils - Soils in land capability class II require improved management practice to reduce erosion and maintain productivity. Dominant class II soils in the basin are Maury, Shelbyville, Lowell, and Loradale. These soils can be used for continuous row crops but require a modification in tillage and residue management. Reduced tillage may be achieved by using chisel plows instead of conventional moldboard plows. This method disturbs less soil and leaves more residue on a rougher surface.

In situations where roughage is needed for farm use or is marketable, or when capital is unavailable for tillage change, the option of rotations with meadow crops and stripcropping regardless of tillage intensity is feasible on class II soils. This likewise will reduce erosion to soil tolerance levels and is probably the least costly solution when hay or pasture has value to the producer.

Class III Soils - Land capability class III soils are necessary for agricultural production in the basin and, at the same time, are major contributors of erosion. The slope of these soils does not significantly

PLATE III - 2

AREA DEVELOPMENT DISTRICTS

Drainage Area 6966 Square Miles

KENTUCKY RIVER BASIN

KENTUCKY

0 10 20 30
APPROXIMATE SCALE - MILES

0 10 20 30 40
APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM 1:250,000 U. S. G. S. QUADRANGLE SHEETS, TRANSVERSE MERCATOR PROJECTION.

SOURCE Data compiled by River Basin Planning Staff

AUGUST 1980 4-R-37502

USDA-SCS-FORT WORTH, TEXAS 1980

AUGUST 1980 BASE 4-R-34039-2

impede farming activities but is sufficient to accelerate runoff and soil movement. The recommendation for reducing erosion is to maintain as much cover as possible. No-till planting, crop rotations and/or stripcropping are generally the most effective.

Class III soils, such as McAfee, Captina, Bedford, and Beasley silt loam, are capable of being used for continuous row crops if no-till techniques and a high level of management are used. When crop rotations of one-half row and one-half meadow crops (RRMM) are combined with stripcropping, any tillage method is acceptable.[1]

The Maury-Shelbyville group is more fragile. Unless no-till is used, practices such as stripcropping and a rotation of 1 year of row crop and 1 year of meadow are necessary. Even under this system, tillage must be reduced by the substitution of herbicide spraying for cultivation.

Other dominant class III soils in the basin are Lowell, Loradale, Eden, and Beasley silty clay. These require permanent cover or physical practices to control erosion. Rotations with stripcropping appear to provide the best opportunities. These soils can sustain a rotation of 2 years of row crops with 2 of meadow (RRMM) if stripcropped, chisel plowed, and residue left on field.

Class III soils have sufficient slope and characteristics that, when the soils are used for crop production, warrant the use of physical practices to control erosion problems. Consequently, more time is warranted for planning and for applying practices on these soils.

Class IV Soils - Most sloping class IV soils used for crops require a combination of vegetative and physical practices to keep annual erosion rates below 5 tons per acre. Otherwise, the recommended option is permanent cover, which is using class IV land for hay or managed pasture.

The most productive class IV soils are the McAfee-Maury group. If stripcropped and chisel plowed or no-till planted, these soils can sustain a rotation of 2 years of row crops with 2 years of meadow (RRMM). The Lowell-Faywood group can, in areas of low rainfall sustain a rotation of 2 years of row crops and 3 years meadow (RRMMM) with no-till and stripcropping practices. In areas of greater rainfall, only 1 year of row crops should be used. The Salvisa-Beasley group and the Eden soils require stripcropping and no-till practices. The most intensive row crop rotation that would keep erosion levels reasonable on these soils is 1 year of row crop with 4 years of meadow (RMMMM).

Recommendations on all class IV soils should be to encourage the usage of no-till methods and stripcropping with rotations to reduce soil loss, unless terracing is desired.

---

[1]Crop rotations include a planned sequence of crops growing in a regular succession on the same field. In the above example, the rotation includes 2 years of row crops (RR) and 2 years of meadow (MM).

Classes VI and VII Soils

Erosion problems on classes VI and VII soils are substantial whenever the surface layer is disturbed. The obvious recommended usage is permanent cover such as hay, managed pasture, or forest. Given the slopes, soil characteristics and tolerance levels of soils such as Eden, Wiekert, Shelocta, and Cynthiana, the best practice is limited use and no row crops. Since these soils occur in large sections of the basin and are all that are available to some farmers, this recommended practice of permanent cover is not practical. The fact that tobacco bases exist on farms with only classes VI and VII lands practically assures some use of these soils for row crops. On farms where this condition exists, the recommended alternative is to emphasize the usage of stripcropping and planting on the contour. Contour planting impedes soil movement down the slope as do strips of sod crops, which may be used for livestock roughage. In addition, the practice of rotating the strips so that the plot is used for row crops only 1 year out of about 6 allows much of the class VI to approach the soil loss tolerance levels. Since some of the classes VI and VII soils will remain in more intensive agriculture than is suggested for erosion control, the best voluntary approach that can be hoped for is a substantial erosion reduction by using technical practices in combination with crop rotations.

Subclass W Soils

Wet (w) soils are found throughout the basin. These are primarily Newark, Stendall, Lawrence, Taft, Robertsville, Melvin, Mercer, and some Captina and Bedford. The wet soils generally have minor erosion problems and have soil loss tolerance levels similar to those in capability class I. Most of the wet-natured soils are productive, but should not be used for continuous row crop production, particularly if conventional tillage methods are practiced. The wet soils often are highly organic and the practice of leaving additional residue is not as beneficial to soil productivity as with less organic soil. Consequently, the most advantageous farming practices are to reduce tillage by decreasing the use of moldboard plows and cultivators. Substitution of chisel plows, disks and herbicide spraying are less disruptive to the soil and often more fuel efficient. When excessive organic material is left on the surface, soil warming in the Spring is impaired and can reduce germination and productivity. In these situations, the recommendations are to use rotations with small grains, hays and meadow crops with row crops. These rotations also would decrease erosion and sedimentation problems present on some wet flood plain soils which are used for continuous soybeans or corn production.

Subclass S Soils

Soils in the (s) subclass are usually low in productivity due to a limitation of the root zone, such as shallowness or stoniness. In the basin, these are soils such as Boonesborough (II) and Bruno (III and IV). These soils are not normally highly erosible unless continually row cropped. Since these are not major soils of the basin, no recommendation is offered other than using proper management of residue when the soils are cropped. This will minimize the contribution to the erosion problem from these soils.

Table III-1 shows some of the cropping systems that would reduce cropland erosion to the acceptable limits on most of the land capability classes. It also

shows a range in estimated annual erosion rates and a relative cost of the conservation management practices included in the cropping system. The adjusted returns per acre are based on production of corn alone or in combination with hay or pasture for rotations. The adjusted returns are derived from partial budgeting and excludes certain interest and capital investment costs for all cropping systems. The returns are used to indicate the relative impact of using the cropping system.

Table III.1--Alternative Cropping Systems, Average Annual Erosion, Costs, and Income by Land Capability Class and Subclass.
Kentucky River Basin

Land Capability Class/ Subclass	Cropping System	Estimated Average Annual Erosion Acre[1]	Cost of System/ Year*	Adjusted Returns Per Acre[2]
		t/ac/yr	------Dollars---------	
IIe	Conventional tillage continuous row crops	8-16.0	--	155-175
	Conventional tillage, continuous row crops, residue mgt., contouring	3.5-7.5	9.00	146-166
	Conservation tillage, continuous row crops, residue mgt.	3.0-5.0	5.00	138-158
	No-till, continuous row crops, residue mgt.	1.5-2.5	5.00	125-145
IIIe	Conventional tillage continuous row crops	24.0-36.0	--	118-138
	Conservation tillage continuous row crops, residue mgt., contouring	4.5-7.5	9.00	98-118
	Conservation tillage, continuous row crops, residue mgt., grassed waterways, stripcropping	2.0-4.0	18.00	91-111
	No-till, continuous row crops, residue mgt.	2.0-4.0	5.00	90-110
	Conservaton tillage, crop rotation RRMMM, residue mgt.	3.5-5.5	5.00	64-74

Table III-1--Alternative Cropping Systems, Average Annual Erosion, Costs, and Income by Land Capability Class and Subclass (cont.).
Kentucky River Basin

Land Capability Class/ Subclass	Cropping System	Estimated Average Annual Erosion Acre[1]	Cost of System/ Year*	Adjusted Returns Per Acre[2]
		t/ac/yr	------Dollars---------	
IVe	Conventional tillage, continuous row crops	33.0-85.0	--	84-104
	Conventional tillage crop rotation RRMMMM	5.0-11.0	--	43-53
	Conservation tillage, continuous row crops, residue mgt., strip-cropping	3.0-6.0	9.00	65-85
	Conservation tillage, crop rotation R-SG-R (double cropped), parallel terraces and waterways, residue mgt., contouring	3.0-6.0	24.00	57.50-67.50
	Conservation tillage, crop rotation R-SG-MM, terraces and pipe outlets, contouring	1.5-2.5	26.00	14-24
VIe	Conventional tillage, crop rotation RRMMMM, residue mgt.	12.0-30.0	5.00	18.50-28.50
	Land use conversion to cover, hayland or pasture	1.0-5.0	--	0-8

[1]Erosion rates vary depending upon soil types and slope characteristics.
[2]Adjusted returns includes profits, returns to management, and land rent (return to land). These vary significantly depending upon soil type and location.
*Price base - 1978.

APPENDIX A-RESOURCE BASE

The Kentucky River Basin consists of three distinct sections--the upper, middle, and lower. Each section has different surface features, resources, and economic activities that distinguish it from the others. The upper section of the basin is a predominantly forested and steep, mountainous area with deeply dissected valleys. Coal mining is the major industry. Agricultural enterprises are limited and are confined mostly to the narrow flood plain areas. In the middle or Bluegrass section, the topography is gently rolling and the soils are more fertile and suitable for agricultural production. This section is more densely populated and the economy is diversified with agriculture, manufacturing and service industries being the major activities. The Bluegrass area is also widely known for its horse farms and burley tobacco production. The lower section is topographically rougher and has more shallow and less fertile soils than the middle portion. A diversified type of agriculture prevails, with most of the crops being produced on bottom lands and the flatter ridge areas. The sloping and steeper lands are mostly Eden soils and are used primarily for pasture. Frankfort, the state capital, is in this area and provides employment for many area residents. This appendix highlights some of these distinguishing features and diversified characteristics of the resources in the area.

LOCATION

The basin is located in east-central Kentucky and is completely within the state (plate A-1). It contains 17 complete counties and portions of 24 others (table A.1). The upstream section of the 6,966 square mile area is in Letcher County, near the Kentucky-Virginia state line. From its origin in the southeastern Kentucky mountainous section, the basin extends approximately 175 miles downstream to the Ohio River in Carroll County. The irregular shaped area varies in width from about 30 miles in the lower section to 50 miles in the upstream portion.

Kentucky River, a tributary of the Ohio River originates in Lee County, about three miles east of Beattyville. It is formed by the junctions of North and Middle Forks, with the South Fork entering the main stream at Beattyville. The Kentucky River flows in a northwesterly direction for about 260 miles to its confluence with the Ohio River at Carrollton, Kentucky. It varies in width from a few feet in the upstream reaches to approximately 500 feet in the downstream section.

Principal tributaries of the Kentucky River are North Fork Kentucky River with 1,883 square miles; South Fork Kentucky River with 748 square miles; Middle Fork Kentucky River with 559 square miles; Elkhorn Creek with 509 square miles; Red River with 487 square miles; Dix River with 442 square miles; and Station Camp Creek with 217 square miles.

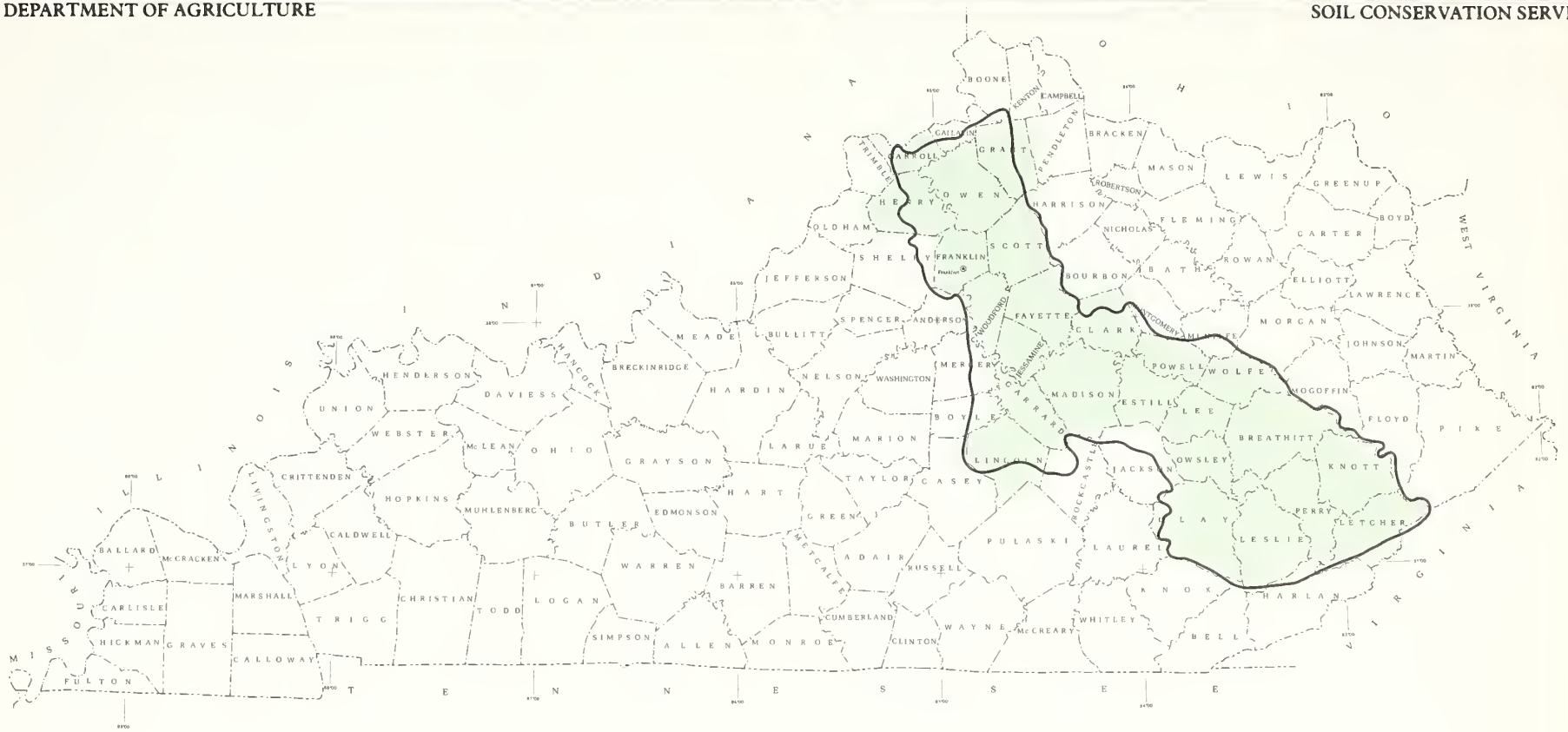
Table A.1--Area by County and Basin
Kentucky River Basin

County	County Area	Portion of County in Basin	
	(Acres)	(Acres)	(Percent)
Anderson	131,840	25,660	19.5
Bell	236,800	6,810	2.9
Boone	166,400	4,395	2.6
Boyle	117,760	49,730	42.2
Breathitt	316,160	316,160	100.0
Carroll	88,320	44,180	50.0
Casey	278,400	2,825	1.0
Clark	165,760	104,275	62.9
Clay	303,360	297,280	98.0
Estill	166,400	166,400	100.0
Fayette	179,840	179,840	100.0
Franklin	135,040	135,040	100.0
Gallatin	67,200	16,015	23.8
Garrard	152,320	152,320	100.0
Grant	160,000	114,650	71.7
Harlan	300,160	32,450	10.8
Henry	184,960	132,730	71.8
Jackson	215,680	110,560	51.3
Jessamine	113,280	113,280	100.0
Kenton	106,880	835	.8
Knott	227,840	170,190	74.7
Laurel	286,080	695	.2
Lee	134,400	134,400	100.0
Leslie	263,680	263,680	100.0
Letcher	216,960	174,275	80.3
Lincoln	217,600	129,195	59.4
Madison	285,440	285,440	100.0
Menifee	134,400	54,860	40.8
Mercer	165,760	49,835	30.1
Montgomery	130,560	16,970	13.0
Morgan	236,160	3,425	1.5
Owen	224,640	224,640	100.0
Owsley	126,080	126,080	100.0
Perry	219,520	219,520	100.0
Powell	110,720	110,720	100.0
Rockcastle	199,040	33,820	17.0
Shelby	245,760	39,470	16.1
Scott	181,760	181,760	100.0
Trimble	98,560	520	.5
Wolfe	145,280	109,790	75.6
Woodford	123,520	123,520	100.0
Total Basin	7,560,320	4,458,240	59.0

Source: Soil and Water Conservation Needs Inventory, Kentucky, 1970; U.S. Department of Commerce and U.S. Geological Survey. Areas are adjusted to include water.

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



LEGEND

HYDROLOGIC BOUNDARY

STUDY AREA

N

PLATE A - 1

LOCATION MAP

KENTUCKY RIVER BASIN

KENTUCKY

0 25 50

APPROXIMATE SCALE - MILES

0 30 60 90

APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM U. S. D. I. KENTUCKY STATE BASE MAP, LAMBERT CONFORMAL CONIC PROJECTION.

AUGUST 1980 4-R-37501

SOURCE: Data compiled by River Basin Planning Staff.

USDA-SCS-FORT WORTH, TEXAS 1981

JANUARY 1978 BASE 4-R-36425

CLIMATE

The climate is temperate, with moderately cold winters and relatively warm summers. All seasons are affected by weather changes that evolve from low and high pressure systems. Mean annual temperature is about 56°F and the monthly temperature range is from 34°F in January to 77°F in July (table A.2). Temperature extremes recorded were -22°F in Beattyville in 1963 and 111° in Frankfort in 1936.

The growing season, which is defined as the number of days between the last damaging frost in the spring to the first one in the fall, averages 184 days. The last frost is usually in April and the first occurs in October.

Annual precipitation, as shown in plate A-2, averages about 46 inches. The monthly distribution is fairly even with October usually having the smallest amount and January the largest. Maximum annual precipitation of 66.9 inches was recorded at Richmond in 1950. Minimum annual rainfall recorded was 30.3 inches at Frankfort in 1934.

Snowfall varies widely, with an average season usually having about 14 days with one or more inches of snowcover on the ground. Thunderstorms occur about 48 days a year and are more frequent in the spring and summer months. Prevailing winds are from southwesterly direction and velocities average 6 to 8 miles per hour during the summer and 8 to 12 miles per hour in the winter.

LAND

The basin is in two land resource areas - the Kentucky Bluegrass (LRA 121) and the Cumberland Plateau and Mountains (LRA 125). These land resource areas are in the east and central farming and forest region of the national land resource regions.

Physiography and Topography

Four physiographic regions occur in the area: namely, the Mountains and Eastern Coalfield; Knobs and Escarpment; Outer Bluegrass; and Inner Bluegrass (plate A-3).

Mountains and Eastern Coalfield - This area is located in the southeastern upstream section and comprises almost one-half of the drainage area. It is a rugged mountainous area with narrow ridge tops, steep slopes, and entrenched valleys. The area is underlain by Pennsylvanian sandstones, siltstones, shales and coal. Principal soils are Jefferson, Latham, and Shelocta, and are well-drained and moderately deep. Some of the landscape has been altered by surface mining which is extensively conducted in some of the counties.

Knobs - This section is between the Mountains and Eastern Coalfield and the Outer Bluegrass. It is underlain by Silurian, Devonian and lower Mississippian rocks of thick units of clay shales, carbonaceous shales, silt shales, and limestones. The area is characterized by conical hills which

Table A.2--Climatological Data from Selected Stations
Kentucky River Basin

Station	Period of Record	Temperatures					Precipitation		
		Mean Annual	Mean Monthly		Recorded Extremes		Mean Annual	Recorded Extremes	
			Jan.	July	Low	High		Min.	Max.
		Degrees					Inches		
Berea	1931-60	57.2	37.6	76.9	-14	105	47.21	32.81	61.25
Danville	1938-67	55.6	34.2	75.4	-19	104	46.41	32.33	63.61
Frankfort	1931-60	56.2	35.8	77.3	-16	111	43.55	30.32	60.66
Heidelburg-Beattyville	1938-67	56.3	36.1	75.5	-22	103	45.61	35.53	56.55
Manchester	1952-69	56.2	36.0	75.5	-18	104	48.35	35.97	61.04
Richmond	1931-60	56.4	36.6	76.3	-15	105	47.90	30.43	66.88
Williamstown	1931-60	55.6	34.0	77.0	-16	110	43.32	27.89	55.77

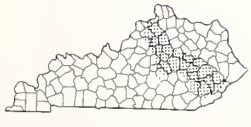
Source: U.S. Department of Commerce, Climatography of the United States, Decennial Census--Kentucky Supplements.

PLATE A-2

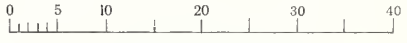
AVERAGE ANNUAL PRECIPITATION

KENTUCKY RIVER BASIN

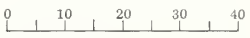
DRAINAGE AREA 6966 SQUARE MILES



VICINITY MAP



APPROXIMATE SCALE - MILES



APPROXIMATE SCALE - KILOMETER

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
COMPILED FROM 1:250,000 USGS MAP SHEETS

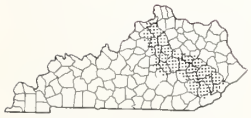
MARCH 1980 4-R-37393

PLATE A-3

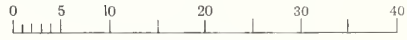
PHYSIOGRAPHIC REGIONS

KENTUCKY RIVER BASIN

DRAINAGE AREA 6966 SQUARE MILES



VICINITY MAP



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
COMPILED FROM 1:250,000 USGS MAP SHEETS

MARCH 1980 4-R-37394

are erosional remnants of surrounding uplands. The edge near the Eastern Kentucky Coalfield is hilly and rough, but toward the Bluegrass there are wide valley floors and bottom lands between the knobs. Soils are shallow on the knobs and are mostly the Shelocta, Colyer, and Rockcastle series. The valley soils are generally acid, low in nutrients and many are poorly drained.

Outer Bluegrass - This area is immediately below the Knobs and surrounds the Inner Bluegrass region. It comprises about 30 percent of the basin and is underlain by upper Ordovician limestones and shales, interbedded. Topography varies from gently rolling areas adjacent to the Inner Bluegrass Region to moderately steep, hilly sections in the lower basin and near the Knobs region. Soils are shallow to moderately deep, with Eden, Nicholson, Faywood, and McAfee being the dominant series.

Inner Bluegrass - This section, which is located in the central portion of the basin, is a broad undulating plain with most slopes ranging from 2 to 7 percent. It is underlain by middle Ordovician rocks, principally limestones, covered by relatively deep, fertile soils. Major soils are Maury, McAfee, and Lowell and are suitable for production of most crops. As inferred by name, the limestone soils are well-suited for bluegrass.

Geology

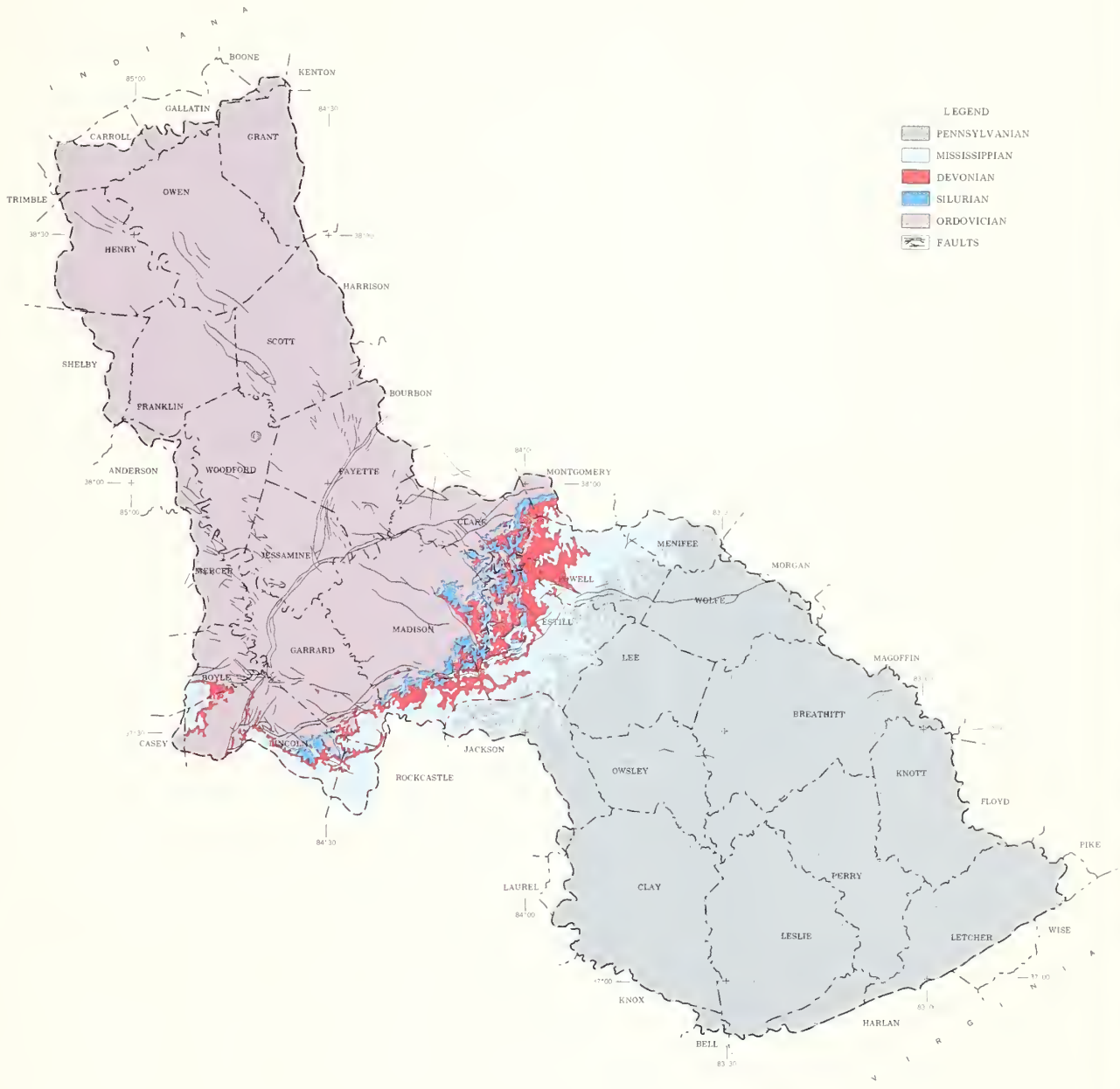
The basin is underlain by hard sedimentary rocks of the Paleozoic Age. As depicted by plate A-4, rocks exposed throughout the area range in stratigraphic sequence from the Middle Ordivician to the Pennsylvanian Systems. The Lexington Series of rocks of the Ordivician System, outcropping in the Bluegrass Region, provide the phosphate beds of Woodford County. Oil slate is present in the Devonian rock exposed in Garrard, Madison, Estill, Clark, and Powell Counties. The Allegheny and Pottsville Series of the Pennsylvanian System outcrop in the upstream section contain many productive coal seams in addition to sandstone and slate. Numerous faults cross the Kentucky River and tributaries above Camp Nelson. The principal fault extends from Boonesboro through Camp Nelson, thence south across Dix River, crossing the main stem of the Kentucky River nine times in 40 miles above Camp Nelson. This cleavage known as the Kentucky River Fault is responsible for the rapidly changing character of the river in this area. Overburden in the basin comprises thin, rocky, rather conglomerate, materials on the hilltops and the slopes of the more rugged sections; rich limestone often phosphatic soils in the Bluegrass Region; shallow alluvial deposits of silty sand and sandy silt in the stream valleys; and swampy, tight clayey materials in the lowlands of the Knobs Region. In all areas, except the Bluegrass Region, the overburden is relatively shallow in depth. The Kentucky River and its principal tributaries are articident streams and most occupy meandering courses having deep entrenchments.

Soil

Soils, like the physiographic and topographic features, vary widely in the area. This variation, while influenced by land-shape patterns and related factors, is reflected by the distribution of soils in the land classification system and the following soil groups. The general groups include a broad aggregation of soils grouped according to their relative positions and related characteristics.

Table A.3--General Soil Groups
Kentucky River Basin

No.	Soil Association Name	Approximate Acres	Percent in Basin	Minor Soils	Description
1.	Otwell-Nolin-Markland	53,200	1.2	Huntington, Melvin and McGary	Deep, well drained loamy soils on flood plains and deep moderately well drained loamy and clayey soils on stream terraces. Generally has good to moderate potential for crops and pasture. Slopes normally range from 0 to about 12 percent.
2.	Lowell-Fairmount-Faywood	199,700	4.5	Mercer, Huntington and Eden	Deep to shallow, well drained clayey soils on rolling to hilly uplands. Slopes generally range from 2 to 20 percent.
3.	Lowell-Mercer	250,900	5.6	Nicholson, Shelbyville and Faywood	Deep, well and moderately well drained soils formed in residuum from limestone. Has good potential for crops and pasture. Slopes usually range from 2 to 12 percent.
4.	Eden	510,000	11.4	Nicholson, Faywood Cynthiana and Boonesboro	Moderately deep clayey soils formed in residuum from thinly bedded limestones and shales on hilly to steep uplands. Predominant slope ranges are from 12 to 35 percent.
5.	Huntington-Newark	35,800	0.8	Captina, Melvin and Morehead	Deep, nearly level, well to somewhat poorly drained loamy soils formed in stream alluvium. Has good potential for most locally grown crops.



VICINITY MAP

PLATE A - 4

GENERALIZED GEOLOGIC MAP KENTUCKY RIVER BASIN KENTUCKY

0 10 20 30
APPROXIMATE SCALE - MILES

0 10 20 30 40
APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM 1:250,000 U. S. G. S. QUADRANGLE SHEETS, TRANSVERSE MERCATOR PROJECTION.

SOURCE: KENTUCKY GEOLOGICAL SURVEY, 1979

AUGUST 1980 4-R-37506

USDA-SCS-FORT WORTH, TEXAS-1980

AUGUST 1980 BASE 4-R-34039-2

Table A.3--General Soil Groups (Cont.)
Kentucky River Basin

No.	Soil Association Name	Approximate Acres	Percent in Basin	Minor Soils	Description
6.	McAfee-Maury-Fairmount	235,500	5.3	Lowell, Faywood and Huntington	Deep to shallow, well drained naturally fertile soils on rolling to hilly uplands. This area has fair potential for cultivated crops. Slopes generally range from 2 to about 30 percent.
7.	Maury-McAfee	337,900	7.6	Lowell, Faywood, Donerail and Huntington	Deep and moderately deep, well drained naturally fertile soils formed mostly in residuum from limestone on undulating to hilly uplands. This area has good potential for cultivated crops. Slopes usually range from 0 to about 20 percent.
8.	Garman-Fredrick	106,500	2.4	Trimble, Bedford Nolin and Newark	Moderately deep loamy soils formed in residuum from limestone, shale and siltstone. Normal slope range is from 20 to about 70 percent.
9.	Culleoka-Eden	132,300	3.0	Lowell, Faywood, Fairmount and Boonesboro	Moderately deep loamy and clayey soils on hilly to steep uplands. This area has fair potential for cultivated crops. Slopes generally range from 6 to about 35 percent.
10.	Beasley-Brassfield Otway	113,700	2.6	Fairmount, Woolper Shrouts and Huntington	Moderately deep soils underlain by marl on hilly to steep uplands. Slopes normally range from 12 to 30 percent.
11.	Colyer-Shrouts-Allegheny	206,900	4.6	Weikert, Captina Trappist and Muse	Shallow, somewhat excessively drained soils on hilly to steep uplands and deep loamy soils on sloping alluvial areas. Generally slopes range from 12 to 50 percent.

Table A.3--General Soil Groups (Cont.)
Kentucky River Basin

No.	Soil Association Name	Approximate Acres	Percent in Basin	Minor Soils	Description
12.	Otway-Fleming-Shrouts	10,200	0.2	Brassfield, Faywood Melvin and Fairmount	Moderately deep clayey soils formed in residuum over marl, limestone, and shale on hilly uplands. Slopes generally range from about 12 to 30 percent.
13.	Morehead-Newark-Monongahela	14,300	0.3	Cuba, Melvin Whitley	Deep, moderately well to somewhat poorly drained soils formed in loamy alluvium on stream terraces and flood plains. This area has fair potential for cultivated crops. Slopes generally range from 0 to 6 percent.
14.	Berks-Cranston	15,400	0.4	Latham, Stendal Tilsit and Pope	Moderately deep loamy soils formed in residuum over siltstones on hilly to steep uplands. Slopes normally range from 20 to about 60 percent.
15.	Shelocta-Brookside	182,300	4.0	Latham, Jefferson, Gilpin and Pope	Deep loamy soils that formed mostly in material from siltstone, shale, sandstone and limestone. They usually occur on benches and along foothills. Predominant slopes range from 20 to 60 percent.
16.	Latham-Shelocta	303,100	6.8	Wernock, Gilpin, Stendal and Cuba	Deep and moderately deep soils formed mostly in material from acid shales, siltstones and sandstones. Slopes normally range from 20 to 50 percent.
17.	Jefferson-Shelocta	1,648,600	37.0	Dekalb, Rigley, Allegheny and Pope	Deep, loamy soils formed in loamy colluvium from acid sandstone, siltstone and shale. Slopes normally range from about 20 to 60 percent.

Table A.3--General Soil Groups (cont.)
Kentucky River Basin

No.	Soil Association Name	Approximate Acres	Percent in Basin	Minor Soils	Description
18.	Cuba-Allegheny-Stendal	39,900	0.9	Monongahela, Pope and Bonnie	Deep, well drained and somewhat poorly drained loamy soils on flood plains and on stream terraces. Has good potential for most locally grown crops. Slopes range from 0 to about 6 percent.
19.	Pope-Allegheny	52,250	1.2	Stendal, Jefferson Shelocta and Monongahela	Deep, well drained loamy soils on flood plains and on stream terraces. Generally has good potential for crops and pasture.

Source: Soil Conservation Service, U.S. Department of Agriculture.

Table A.3 lists the 19 general soil groups in the area. The largest group is Jefferson-Shelocta (No. 17) which covers over 1.6 million acres. This is the dominant group in the upstream mountainous section. Major group in the Inner Bluegrass area is Maury-McAfee (No. 7). This fertile limestone soil group accounts for about 338,000 acres. The Eden group (No. 4), with over 500,000 acres, is the major one in the Outer Bluegrass section. Plate A-5 depicts the general distribution of the 19 soil groups.

Land Capability Classes

Land capability classification is a system used to show the suitability of soils for agricultural production.[1] This system utilizes three basic categories for grouping soils; namely, capability class, subclass, and unit. The broadest category, capability class, is used for grouping soils into eight different classes according to limitations and risks which affect use. The risks of soil damage and limitations in use are progressively greater from class I through class VIII. As shown in table A.4, approximately 75 percent of the cropland is in land capability classes I through III which are usually more productive and have fewer use limitations. All land capability classes are used for pasture, but about 60 percent is in classes IV through VIII. Ninety-seven percent of the forestry acres is in the steeper capability classes, IV through VIII.

Capability subclasses are used for grouping soils having similar limitations or hazards. The hazards or limitations recognized in the basin include erosion, wetness, and shallowness or stoniness. These hazards are identified by the the letters "e," "w," and "s." Approximately 54 percent of the acreage in table A-4 is in the erosion (e) subclass, 39 percent in the shallowness (s) subclass, 3 percent in the wetness (w) subclass, and about 4 percent has no significant limitations.

Capability units, the smallest subdivision, are groups within the subclass. Although these units are not shown in table A.4, they are used to designate soil groups adapted to specific cultivated crops or pasture plants and require similar management practices. Capability units are reflected by numbers, usually 1 through 20.

Flood Plain Land

Slightly over 200,000 acres are in the flood plain areas. This includes about 100,000 acres of class I, 65,000 acres of class IIw, and 35,000 acres of class IIIw and IVw land. Principal flood plain soils are Huntington, Allegheny, Nolin, Otwell, Pope, Newark, and Cuba. Some flood plain land is on the smaller tributaries, but the major portion is located on the main stem of the Kentucky River and on Elkhorn Creek, Red River, and larger tributaries.

Prime Farmland

Approximately 550,000 acres of prime farmland is in the basin. This includes acreage in land capability classes I and II land and some in III. As

[1]"Land Capability Classification"; Agricultural Handbook No. 210, Soil Conservation Service, U.S. Department of Agriculture, September 1966.

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

PLATE A - 5

GENERAL SOIL MAP
KENTUCKY RIVER BASIN

DRAINAGE AREA 6966 SQUARE MILES

LEGEND

1	OTWELL–NOLIN–MARKLAND	7	MAURY–McAFEE	14	BERKS–CRANSTON
2	LOWELL–FAIRMOUNT–FAYWOOD	8	GARMON–FREDERICK	15	SHELOCTA–BROOKSIDE
3	LOWELL–MERCER	9	CULLEOKA–EDEN	16	LATHAM–SHELOCTA
4	EDEN	10	BEASLEY–BRASSFIELD–OTWAY	17	JEFFERSON–SHELOCTA
5	HUNTINGTON–NEWARK	11	COLYER–SHROUTS–ALLEGHENY	18	CUBA–ALLEGHENY–STENDAL
6	McAFEE–MAURY–FAIRMOUNT	12	OTWAY–FLEMING–SHROUTS	19	POPE–ALLEGHENY
		13	MOREHEAD–NEWARK–MONONGAHELA		

0 5 10 15 20

APPROXIMATE SCALE MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION COMPILED FROM 1:250,000 USGS MAP SHEETS

GRID TICKS BASED ON KENTUCKY STATE PLANE COORDINATE SYSTEM, NORTH ZONE

VICINITY MAP

SOURCE: Original draft by State Soil Survey Staff.

AUGUST 1977 4-R-36168

REVISED MARCH 1976 4-R-34039

USDA—SCS—FORT WORTH TEXAS 1980

shown in plate A-6, the prime land is distributed throughout the basin, with the greatest concentration being in the central Bluegrass area. About 55 percent of the prime farmland is used for crops and 45 percent for pasture.

Table A.4--Land Use for Agricultural and Nonagricultural Areas
Kentucky River Basin

Capability Class and Subclass	Major Land Use and Acreage[1]					Percent Total
	Cropland	Pasture	Forest	Other[2]	Total	
I	49,100	40,800	8,500	9,700	108,100	2.4
IIe	205,500	166,800	13,900	23,500	409,700	9.2
IIw	36,900	19,100	7,100	4,200	67,300	1.5
IIs	6,200	4,800	4,700	5,300	21,000	.5
IIIe	133,100	207,100	38,200	19,100	397,500	8.9
IIIw	17,600	14,100	2,800	2,700	37,200	.8
IIIs	4,200	800	2,000	500	7,500	.2
IVe	75,900	177,600	37,000	12,000	302,500	6.8
IVw	2,100	3,100	2,000	500	7,700	.2
IVs	1,200	600	2,400	500	4,700	.1
VIe	47,900	284,500	254,000	7,700	594,100	13.4
VIs	5,200	32,000	11,400	1,600	50,200	1.1
VIIe	8,300	73,400	423,900	7,000	512,600	11.5
VIIs	8,800	81,200	1,414,800	29,600	1,534,400	34.5
Other	1,700	4,900	13,600	12,120	32,320	.7
Subtotal	603,700	1,110,800	2,236,300	136,020	4,086,820	92.0
Federal Land	--	--	178,780	23,120[3]	201,900	4.5
Water	--	--	--	27,210[4]	27,210	.6
Urban	--	--	--	126,950	126,950	2.9
Subtotal	--	--	178,780	177,280	356,060	8.0
Total Basin	603,700	1,110,800	2,415,080	313,300	4,442,880	100.0

[1]Compiled from the 1970 Kentucky Soil and Water Conservation Needs Inventory, adjusted using U.S. Agriculture Census and recent SCS and FS data.

[2]Includes farmsteads, farm roads, feed lots, ditch banks, fence and hedge rows, miscellaneous farmlands, nonfarm residences, investment and industrial tracts, built-up areas smaller than 10 acres, gravel pits, and borrow areas.

[3]Includes 8,800 acres of water and 14,320 acres of other federal land.

[4]Includes water areas other than Corps of Engineers reservoirs.

Principal upland soils included in prime land are Maury, Lowell, Loradale, McAfee, Nicholson, Shelbyville, and Mercer. Prime flood plain soils include Huntington, Nolin, Pope, Newark and Cuba.

WATER QUANTITY AND QUALITY

The basin receives an average of 46 inches of precipitation annually. About 63 percent of this returns to the atmosphere via evaporation and transpiration, around 28 percent enters the stream system, and about 9 percent filters underground to supply wells and springs.

Surface Water

Surface water resources consist of 88 principal streams with a total length of 2,053 miles and a surface area of approximately 11,000 acres; 2 flood control reservoirs and 1 hydroelectric impoundment with combined surface areas of 4,880 acres; 120 small lakes containing 2,896 acres; and about 2,245 farm ponds whose surface areas total 2,400 acres. These surface water sources provide most of the municipal, industrial and agricultural water supplies.

Runoff from the drainage area averages about 17 inches annually. This runoff, coupled with the annual precipitaion, would normally provide a sufficient supply of water for the basin if evenly distributed. However, many of the area streams are small and have low flow characteristics, resulting in seasonal shortages. This condition is more prevalent in the Bluegrass Region.

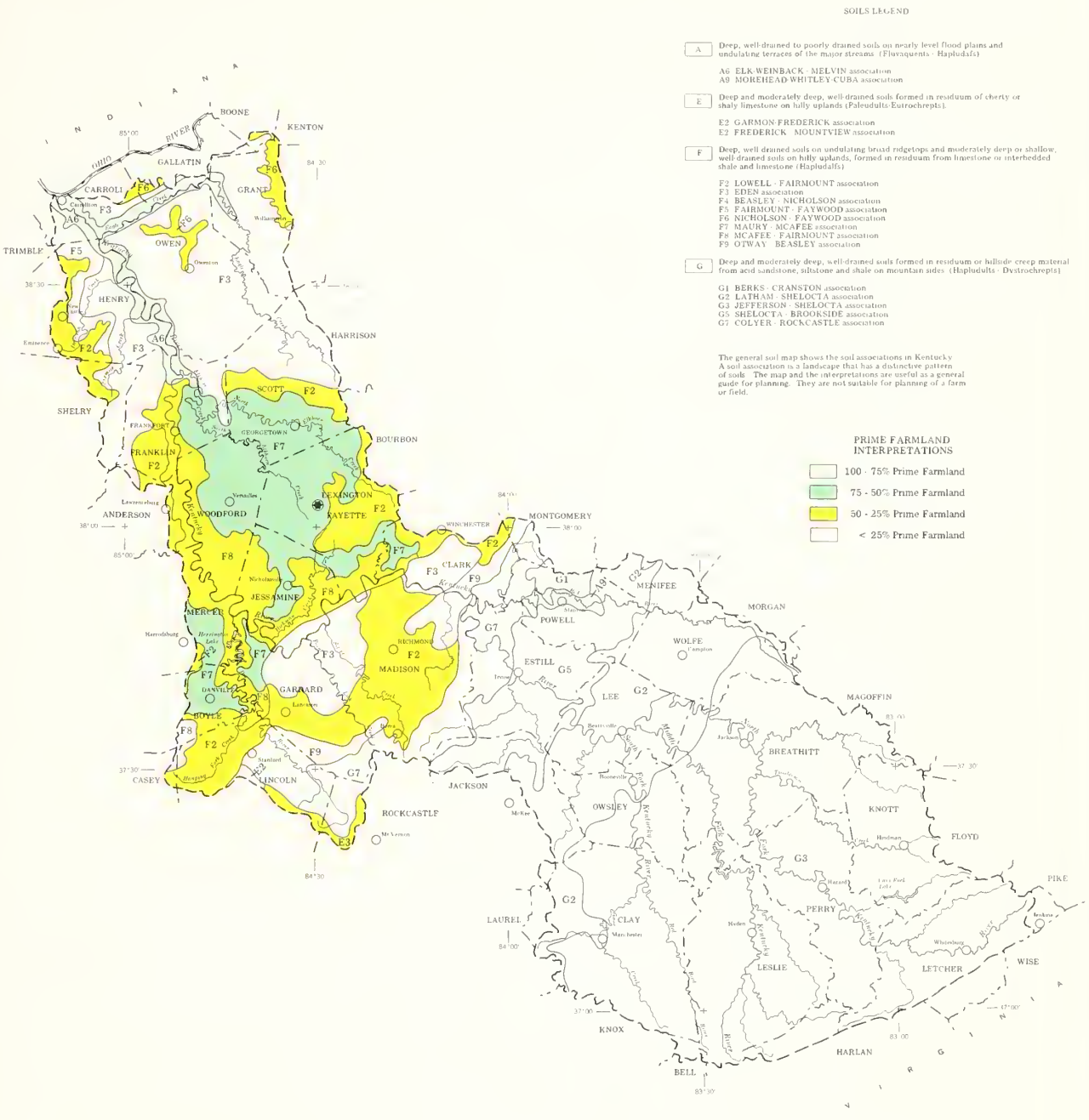
The major source of municipal and industrial water is the Kentucky River. Average cubic feet per second (cfs) flow of the river at Locks 14, 10, and 4 is 3,638, 5,274, and 7,109, respectively (table A.5). Average yield of the basin on the main stem of the river is 1.33 cfs per square mile. Historically, the Kentucky River has experienced extremely low flows. For example, during October of 1930, the flow at Lock 10 dropped to less than 10 cfs. The low flow

Table A.5--Streamflow Characteristics of the Kentucky River
Kentucky River Basin

Location	Drainage Area (Square Mile)	Discharge (CFS)		
		Average	Q7-20[1]	Minimum
Lock 14	2657	3638	10.1	4
Lock 10	3955	5274	26.5	10
Lock 8	4414	5503	36.2	ND
Lock 6	5102	6751	131.0	15
Lock 4	5412	7109	129.0	ND
Lock 2	6180	8307	128.0	ND

[1]7-day-20 year low-flow.
ND - Not Determined.

Source: Special Water Supply Report prepared by the U.S. Army Corps of Engineers, Louisville, Kentucky District



VICINITY MAP

PLATE A - 6

PRIME FARMLAND
KENTUCKY RIVER BASIN
KENTUCKY

0 10 20 30
APPROXIMATE SCALE - MILES

0 10 20 30 40
APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM 1:250,000 U. S. G. S. QUADRANGLE SHEETS, TRANSVERSE MERCATOR PROJECTION.

AUGUST 1980 4-R-37504

SOURCE Data compiled by River Basin Planning Staff.

AUGUST 1980 BASE 4-R-34039-2

regime of the upper reaches of the Kentucky River has been altered by rule curve releases from Buckhorn Lake and Carr Fork Lake in the headwaters. Power releases and leakage from Herrington Lake on the Dix River supplement flows available at Lock 7 and downstream.

In the upper reaches of the basin, tributary streams have slightly better low flow characteristics than in the Bluegrass Region. Some of the small mountain communities without supplemental water supply storage withdraw water from tributaries. However, reservoir construction has been necessary to meet the water demands of the larger users in the Mountains and Eastern Coalfield Region.

The larger water impoundments in the area are Carr Fork Lake, Buckhorn Lake, and Herrington Lake. Carr Fork and Buckhorn are federal impoundments and Herrington Lake, a privately owned development.

Carr Fork dam is located on Carr Fork, a tributary of the North Fork of the Kentucky River about 8.8 miles above their confluence, near Vicco, Kentucky. The project is designed to include storage for flood control, water quality maintenance, and recreation. The dam is an earth and rockfill structure with a maximum height of 130 feet. An opencut spillway, 285 feet wide, protects the structure from overflows. The dam controls an area of 58 square miles and has the following storage amounts allocated to project purposes:

	Elevation (Feet msl)	Area (Acres)	Storage (Acre-feet)
Minimum Pool	1,009	520	11,830
Water Quality Pool	1,009-1,017	590	4,330
Seasonal Pool	1,017-1,027	710	6,480
Flood Control Pool	1,017-1,055	1,120	31,560
Total Storage	1,055	1,120	47,720

Buckhorn Lake is located in Perry County about 15 miles west of Hazard, Kentucky. The dam site is on the Middle Fork of the Kentucky River 43.4 miles above the mouth. The dam is a rockfill-earth core type with a maximum height of 162 feet. A 150-foot gated spillway in the right abutment protects the structure from overflows. The dam controls an area of 409 square miles and has the following storage amounts allocated to project purposes:

	Elevation (Feet msl)	Area (Acres)	Storage (Acre-feet)
Minimum Pool	757	555	10,300
Seasonal Pool	757-782	1,230	21,700
Flood Control Pool	757-840	3,610	157,748
Total Storage	840	3,610	168,048

The largest non-federal reservoir is Herrington Lake located on the Dix River in Mercer and Garrard Counties. Herrington Lake was placed in operation by Kentucky Utilities in November, 1925. It was originally constructed and is maintained and operated for use in the generation of electric power for public

use. The lake is used to operate the Dix Dam hydroelectric plant and for cooling water withdrawals at Kentucky Utilities' E.W. Brown Generating Station. It is also used as a public water supply by the City of Danville and Kentucky State Hospital. Herrington Lake contains a usable storage volume of 123,200 acre-feet, covers 2,350 acres and controls 439 square miles of the Dix River Basin. Usable capacity is measured between elevations 760 (top of spillway gates) and 680 (minimum pool). The amount of dead storage in the minimum pool is unknown. The reservoir is formed by a 287-feet high earth and rockfill dam and has a side channel spillway controlled by 10 vertical lift gates. Historically, releases for hydropower generation and leakage from the dam have sustained low-flows in the Kentucky River downstream from Dix River. Prior to 1974, when a leak repair program was undertaken, leakage was estimated at 165 cfs. The leakage has since been reduced to 95 cfs.

Ground Water

Ground water availability varies throughout the basin and is closely related to the existing geologic formation. In the Bluegrass Region, most wells drilled into alluvial deposits yield enough water for domestic use. Wells drilled into bedrock in the Outer Bluegrass often are undependable for home use. Some springs are used for domestic water supplies, with the most notable one being Royal Spring, which provides the main water supply for the City of Georgetown. Water from wells and springs in the study area is usually hard and of the calcium-magnesium bicarbonate type.

In the mountainous Eastern Coalfield Region, wells often yield adequate quantities of water for small industrial or public supplies. However, frequent problems with chlorides, iron, sulfates and other contaminants are encountered.

Water Quality

Water quality varies by area and by season and depends largely upon local geological conditions, streamflow characteristics, and quantity of waste water and effluent material discharged. Except for the coal mining area and certain urban sections, most of the streams do not generally have significant water quality problems. The more obvious water quality problems occur in the coal mining areas in the southeastern section, the limestone section in the Bluegrass and on streams below towns and communities having inadequate sewage treatment facilities.

Water quality in coal mining sections in the southeastern area is affected by sediment, coal waste materials, and chemicals. These pollutants, which are transported by runoff from disturbed mining areas to nearby streams, are evidenced by the excessive turbidity, water discoloration, and chemical content of the water. The quality of water on all three upstream forks of the Kentucky River and many of their tributaries are affected by these pollutants, with North Fork being most seriously affected. These pollutants also affect water quality in the Kentucky River, but the pollutants become less concentrated as the water moves downstream.

Although the quality of water is affected by several pollutants in the central and lower sections, dissolved minerals and waste effluent are probably

the most serious. Both surface and groundwater in the limestone area, particularly the latter, are affected by dissolved minerals, mainly calcium carbonate and magnesium. Contaminants from industrial and domestic waste plants, coupled with bacterial pollutants carried by surface runoff to streams and underground sources, affect the quality of water in the Inner and Outer Bluegrass regions. These pollutants not only affect the quality for domestic use, but for recreation and aquatic life as well.

MINERALS

Coal is currently the most economically important mineral resource in the area. Other minerals or mineral resources include limestone, sand, gravel, clay, gas, oil shale, and oil (plate A-7).

Coal

The Eastern Coalfield area in the upstream portion of the basin is the principal coal producing section of the state. Coal produced in this region accounted for almost two-thirds of the 148 million tons mined in Kentucky in 1977. Basin counties produced over 52 million tons, about one-third of the state total and over one-half of the quantity produced in the Eastern Coalfield (table A.6).

Table A.6--Coal Production and Type of Mining, 1977[1]
Kentucky River Basin

County	Coal Mining Methods		Total
	Surface	Underground	
	----------Tons----------		
Breathitt	5,629,000	97,300	5,726,400
Clay	876,400	371,700	1,248,100
Knott	2,511,300	2,817,900	5,329,200
Lee	298,000	35,700	333,700
Leslie	2078,600	641,300	2,719,900
Letcher	1,558,600	3,183,500	4,742,100
Owsley	499,800	0	499,800
Perry	6,127,900	25,344,100	31,472,000
Wolfe	483,300	0	483,300
Total	20,063,000	32,491,500	52,554,500

[1]Source: Annual Report of the Kentucky Department of Mines and Minerals for Kentucky, 1977

Approximately 60 percent of the coal is mined by underground methods. Of the coal produced, about 80 percent is in Perry, Breathitt and Knott Counties with Perry accounting for more than one-half of the total. Over 1,200 mines are in the area and employee some 13,500. Service type and other mine related activities provide additional employment opportunities.

Coal mining activities have affected about 98,000 acres. Approximately one-half of the affected acreage has been reclaimed and revegetated. A portion of the remaining acreage is partially stabilized.

Geological studies indicate that the coal reserves in the area approach 3.4 billion tons. Under present mining methods, about 127 million tons are economically and physically feasible to surface mine. The remaining 96 percent would require underground mining methods.

Sixteen counties or portions of counties have coal reserves that are minable by both surface and underground methods. Five counties (Perry, Knott, Leslie, Lee, and Breathitt) account for 91 percent of the total coal reserve with Perry and Knott having about 950 million tons each. Leslie, Lee, and Breathitt have reserves ranging from over 500 million to 685 million tons.

Oil and Gas

Production of oil and gas are becoming increasingly more important. Oil production is primarily in Lee, Letcher, Estill, and Powell Counties with scattered wells in other counties (table A.7). About 1.4 million barrels were extracted from the fields in the basin in 1977.

Table A.7--Petroleum Production
by Counties, 1977[1]
Kentucky River Basin

County	Yield (42-gal barrels)
	(1,000)
Breathitt	19
Clay	7
Estill	115
Knott	11
Lee	798
Letcher	347
Owsley	1
Powell	123
Wolfe	43
Total	1,464

[1]Source: Kentucky Geological Survey

The largest natural gas field in the area is in Knott, Perry, and Letcher Counties. Other known natural gas fields are located in Clay, Leslie, Breathitt, Wolfe, and Owsley Counties, with the largest being located in Clay County. Presently natural gas in the area is not significant when compared to the national demand.

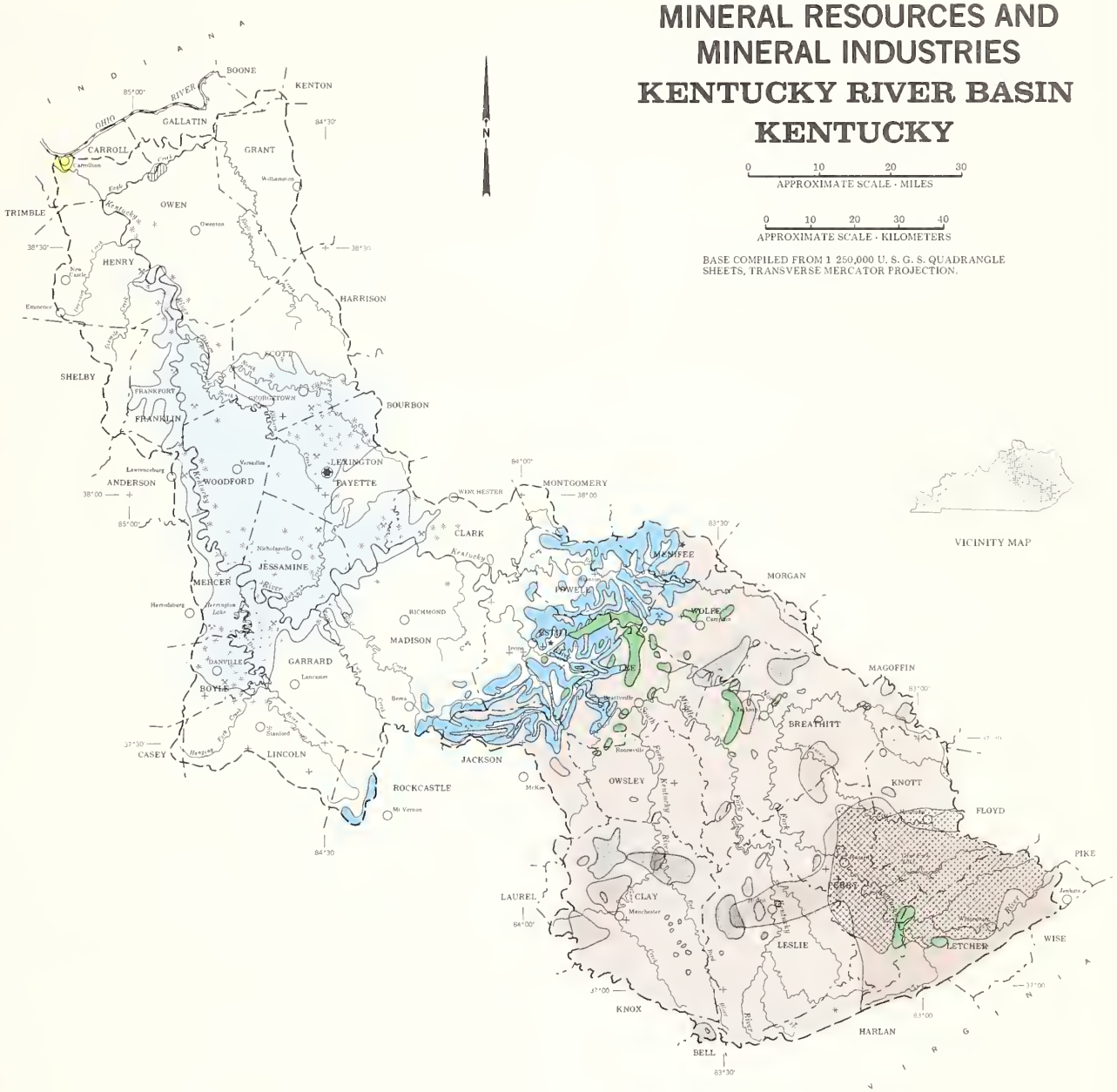
PLATE A - 7

MINERAL RESOURCES AND MINERAL INDUSTRIES KENTUCKY RIVER BASIN KENTUCKY

0 10 20 30
APPROXIMATE SCALE - MILES

0 10 20 30 40
APPROXIMATE SCALE - KILOMETERS

BASE COMPILED FROM 1 250,000 U. S. G. S. QUADRANGLE SHEETS, TRANSVERSE MERCATOR PROJECTION.



VICINITY MAP

	COAL	PETROLEUM	NATURAL GAS	LIMESTONE and DOLOMITE	CLAY and SHALE	SAND, GRAVEL and SANDSTONE	FLUORSPAR and OTHER VEIN MINERALS
RESOURCES	COAL FIELD	In recent years secondary recovery methods (primarily water flooding) in many of the old fields has become increasingly important in the recovery of oil in Kentucky. The most depleted or abandoned oil fields are not shown.	Ninety percent of Kentucky's annual gas production comes from the Big Sandy gas field in Eastern Kentucky. Depleted fields are not shown.	PRINCIPAL AREAS OF OCCURRENCE: LIMESTONE WITH HIGH CALCIUM ZONES; LIMESTONE	PRINCIPAL AREAS OF OCCURRENCE: + OTHER TYPES (Analysis available)	PRINCIPAL AREAS OF OCCURRENCE: MISCELLANEOUS SAND and GRAVEL (The widespread sand and chert gravel deposits of the region west of Cumberland River are not included); * HIGH SILICA SAND or SANDSTONE (Analysis available)	PRINCIPAL AREAS OF OCCURRENCE: * REPORTED VEIN MINERAL OCCURENCE
INDUSTRY	PRINCIPAL PRODUCING AREA	PRINCIPAL PRODUCING AREA	BIG SANDY GAS FIELD; OTHER GAS FIELDS; STORAGE FIELD	CRUSHED STONE QUARRY or MINE	OPERATION OUTSIDE PRINCIPAL CLAY AREA	SAND and/or GRAVEL OPERATIONS	

SOURCE Data compiled by River Basin Planning Staff

AUGUST 1980 4-R-37507

SCS-SCS-1041 WORTH TEXAS 1980

AUGUST 1980 BASE 4-R-34039-2

Oil Shale

Past prospects have not been favorable for extracting oil and gas from oil shale due principally to economic, technological and environmental problems. As economic conditions become more favorable due to energy price increases and improved extracting and processing technology, a new industry may be forthcoming.

There are several counties within the Knobs Physiographic Region of the basin that are underlain by oil shale. These counties include Lincoln, Boyle, Garrard, Madison, Clark, Montgomery, Jackson, Lee, Wolfe, Powell, and Estill. Not only is oil shale valuable for its potential oil and gas, but also for its potential uranium and thorium content.

Limestone

Mining of limestone is a significant industry, primarily producing crushed stone for the construction industry. The concentration of quarries is in the Blue Grass area and includes Fayette, Franklin, Woodford, Mercer, Boyle, and Jessamine Counties.

Other Minerals

Mining of clays and shales for use in pottery and brick manufacturing is found in Madison and Clay Counties. Sand and gravel for use in the making of glass products and the construction industry are scattered throughout the basin. The largest of these areas is located at the mouth of the Kentucky River along the Ohio River.

FOREST RESOURCES

Forest land totals 2,415,080 acres or 54 percent of the study area. Of this, 98 percent or 2,373,680 acres is commercial forest land.[2] Since 1968 the commercial forest land has increased by 108,600 acres or approximately 5 percent. The majority of this change is resulting from abandoned pastureland in the northern and central portions of the basin.

Approximately 93 percent of the forest land is privately owned. Individuals holding less than 100 acres comprise 95 percent of the private ownership. Being part of a farm, domestic use, or being part of residential property are the main reasons for forest land ownership. Timber management is usually a minor consideration. Seven percent of the forest land is federal forest. Table A.8 gives additional details about forest land ownership.

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[2]See Glossary for definition.

Table A.8--Estimated Acres of Commercial Forest Land
By Ownership Class, 1978
Kentucky River Basin

Basin Subarea	Hills Of Bluegrass	Bluegrass	Mountains and Coalfield	Total
	----------Thousand Acres----------			
Individual[1]	235.4	207.5	1,299.2	1,742.1
Corporation	9.5	8.4	227.8	245.7
Partnership	9.6	8.4	--	18.0
Undivided Estates	15.9	14.0	140.6	170.5
Federal Forest	--	1.5[2]	177.3[3]	178.8
Other	--	--	10.9	10.9
Total	270.4	239.8	1,855.8	2,366.1

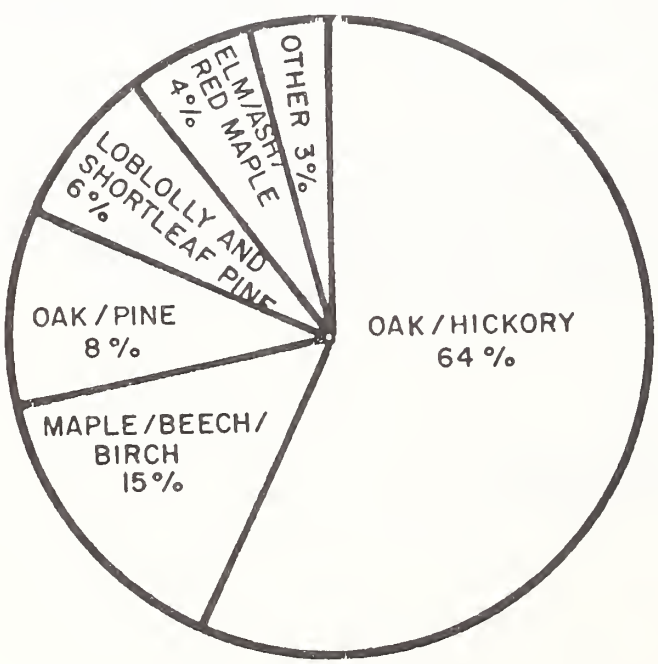
Source: U.S. Forest Service

[1]Includes joint ownership

[2]Bluegrass Army Depot

[3]176,430 acres administered as part of the Daniel Boone National Forest and 850 acres of Jefferson National Forest

DISTRIBUTION OF MAJOR FOREST TYPES
KENTUCKY RIVER BASIN



The basin area is in or near the prime range of many of the most prominent hardwood timber species. Hardwoods constitute over 90 percent of the timber volume. An assortment of pines and eastern redcedar comprise the non-hardwood species. Forest land in the area is stocked with an estimated 2 billion cubic feet or 5.2 billion board feet of timber.[3] This is approximately 18 percent of the total for the state. Hickory and poplar are the most dominant forest tree species. Each composes 13 percent of the growing stock. Other species and the percent of cubic feet growing stock that each comprises include white oak, 9.8 percent; black oak, 8.7 percent; and chestnut oak, 8.4 percent.

In terms of market value and rate of return on investment, black walnut and white oak are the prime species. Good grade trees, especially black walnut, are in demand for veneer stock. Some forest sites in the lower portion of the basin have potential to produce quality hardwood whose value is among the highest nationally.

Sawtimber stands constitute 49 percent of the commercial forest lands. Seedling and sapling stands and poletimber stands comprise 27 and 22 percent, respectively.

Forest resources are used for a variety of purposes and make contributions in addition to timber production. These include outdoor recreation, wildlife habitat, forage production, aesthetic enhancement, soil stability, water runoff reduction, and improvement of water quality.

FISH AND WILDLIFE

Fish and wildlife resources of the basin consist of an estimated 116 species of fishes, 67 species of reptiles and amphibians, 48 species of mammals and 121 species of breeding birds. Many of the 200 other species of birds that visit the state each year can be found at some time during the year.

Distribution and quantity of fish and wildlife depends largely upon the distribution of the types of habitat available. For terrestrial species, approximately 600,000 acres of cropland, 1.1 million acres of pastureland, and 2.2 million acres of forest land are available. In the northwestern half of the basin these land uses are interspersed and are favorable for wildlife such as the bobwhite quail, mourning dove, and cottontail rabbit. Forest species, particularly the ruffed grouse and gray squirrel, are concentrated in the mountainous section where woodland dominates the landscape.

The basin is too far from the major waterfowl flyways and lacks suitable habitat to be used much by ducks and geese. Since most stream valleys are narrow, topography is hilly or mountainous and streams are entrenched, there is little cropland or timberland that is attractive to ducks. Wood ducks do nest along many of the streams, and migrating fowl regularly stop to rest on the larger bodies of water. About 31 species are known to visit the area, but only

[3]International ¼-inch rule.

18 are considered common transients or winter residents. Because of their limited presence, waterfowl do not constitute a major component of the basin's wildlife resources.

Aquatic wildlife and fish habitat consists of 88 principal streams with a total length of 2,053 miles and a total surface area of approximately 11,000 acres, 2 flood control reservoirs and 1 hydroelectric impoundment whose combined surface areas total 4,880 acres, 120 small lakes containing 2,896 acres, and 2,245 farm ponds whose surface areas total 2,400 acres.

Sport fishing and hunting are the principal uses made of the fish and wildlife resources. In recent years, however, interest in bird watching, wildlife photography, and nature study has increased rapidly. Commercial fishing is insignificant, as is commercial fur trapping, even though the recent increase in fur prices has stimulated interest in trapping.

The more important game birds and mammals are the bobwhite quail, mourning dove, ruffed grouse, cottontail rabbit, gray squirrel, raccoon, and white-tailed deer. Mink, muskrat, and foxes are the furbearers most sought by trappers.

Principal game and pan fishes are the largemouth bass, smallmouth bass, Kentucky bass, rock bass, white bass, crappie, muskellunge, bluegill, and channel catfish. Rainbow trout for put-and-take fishing are stocked in some streams.

Other fish and wildlife resources that are of special interest to scientists, bird watchers, and nature study enthusiasts are those designated threatened or endangered by the Endangered Species Act of 1973 (PL 93-205). The current list includes the Indiana bat, Gray bat, Red cockaded woodpecker, and American peregrine falcon. All of these are known to be either permanent or part-time residents of the basin.

RESOURCES USES

Approximately 92 percent of the 4.4 million acre area is privately owned and is predominantly rural land. The remaining 8 percent includes about 202,000 acres of federally owned land, 127,000 acres of urban and 27,000 acres of water. Agricultural, mining, and timber are the dominant uses of the rural land and urban development and recreation are major uses of the nonrural lands.

Land Use

Land use and related data are reported by subarea rather than hydrologic area. The 4,458,240 acre hydrologic area includes 17 complete counties and portions of 24 others. Most published data from secondary sources are reported on a county or area basis. To facilitate using the published data, a 24-county area is selected to represent the basin. This 4,442,880-acre area, referred to as the study area, is further divided into three multicounty subareas. These three subareas are shown in table A.9. Each includes counties having similar geographic, economic, and related characteristics.

Table A.9--Counties and Acres in Selected Subareas
Kentucky River Basin

Subareas and Counties[1]					
Subarea I	Acres	Subarea II	Acres	Subarea III	Acres
Carroll	88,320	Clark	165,760	Breathitt	316,160
Franklin	135,040	Fayette	179,840	Clay	303,360
Grant	160,000	Garrard	152,320	Estill	166,400
Henry	184,960	Jessamine	113,280	Knott	227,840
Owen	224,640	Lincoln	285,440	Lee	134,400
		Madison	217,600	Leslie	263,680
		Scott	181,760	Letcher	216,960
		Woodford	123,520	Owsley	126,080
				Perry	219,520
				Powell	110,720
				Wolfe	145,280
Total	792,960		1,419,520		2,230,400

[1]Subarea I represents the lower portion of the basin and is referred to as the Hills of the Bluegrass. Subarea II is the central portion and is called the Bluegrass Region. Subarea III is the southeastern section and is referred to as the Mountains and Coalfield.

As previously shown in table A.4, slightly over 4 million acres are considered as being in the rural area. This includes almost 604,000 acres classed as cropland, 1.1 million acres of pasture, 2.2 million acres of forest, and 136,000 acres in farmsteads, roads, and other uses. Approximately 56 percent of the 4 million acre rural area is in farms. Non-farm acreage in the rural section includes lands in forest and mining tracts, small villages, and other areas not classified as farms.

Table A.10 shows the agricultural land use for selected years by subareas, basin, and state. As shown in this table, about 77 percent of the 793,000 acres in the lower section of the basin, subarea I, is in farms. In 1974, this area had 4,230 farms that averaged 144 acres in size. Of the 610,000 acres in farms, about 58 percent is cropland and pastureland, 20 percent woods and 22 percent in other uses.

The central section of the basin, subarea II, has the highest percentage of the land area in farms. In 1974, this subarea had 1,233,000 acres or 87 percent of the 1,419,500 acre area in farms. It had 8,486 farms that averaged 145 acres in size. The farms contained about 67 percent cropland and pastureland, 11 percent woods, and 22 percent other. The latter includes farmsteads, roads, and idle lands.

Table A.10--Major agricultural land use by subarea, basin, and state for selected years. Kentucky River Basin

Land Use	Region[1]	All Farms					
		1949	1954	1959	1964	1969	1974
		Acres (000)					
Total land (harvested, pastured, or in other uses)	HBG	736	707	716	673	688	610
	BG	1,293	1,228	1,296	1,251	1,299	1,233
	MCF	1,256	1,097	828	696	572	423
	Basin	3,284	2,033	2,839	2,619	2,558	2,266
	State	19,442	18,034	17,031	16,265	15,968	14,431
A. Total cropland	HBG	455	433	502	365	297	355
	BG	933	868	857	843	903	830
	MCF	486	400	267	197	161	130
	Basin	1,874	1,701	1,526	1,405	1,461	1,315
	State	11,601	10,445	9,927	9,364	9,443	8,803
1. Harvested	HBG	144	127	111	103	84	90
	BG	321	294	273	241	208	224
	MCF	150	114	80	46	28	32
	Basin	615	535	464	390	320	346
	State	5,054	4,541	4,013	3,473	3,128	3,701
2. Pastured & grazed	HBG	294	277	264	222	260	235
	BG	591	554	556	554	630	800
	MCF	231	163	118	89	86	79
	Basin	1,116	994	938	865	976	1,114
	State	5,265	4,880	4,740	4,572	4,916	4,487
3. Other	HBG	17	29	26	41	52	30
	BG	22	20	28	48	66	41
	MCF	105	123	70	61	48	19
	Basin	144	172	124	150	166	90
	State	1,282	1,034	1,174	1,319	1,400	615
B. Woodland	HBG	87	120	142	122	123	124
	BG	145	122	143	126	154	134
	MCF	631	589	486	425	303	220
	Basin	863	832	772	674	580	478
	State	4,903	4,850	4,496	4,247	3,883	3,206
C. Other	HBG	195	154	172	185	168	131
	BG	214	238	296	280	242	269
	MCF	139	109	74	74	107	73
	Basin	548	501	542	539	517	473
	State	2,938	2,729	2,608	3,655	2,702	2,423

Table A.10--Major agricultural land use by subarea, basin, and state for selected years. Kentucky River Basin

Land Use	Region[1]	All Farms					
		1949	1954	1959	1964	1969	1974
		Acres (000)					
Total irrigated land[2]	HBG	NA	921	563	1,856	3,019	2,069
	BG	NA	2,140	1,821	2,329	4,664	1,680
	MCF	NA	81	14	1	30	41
	Basin	NA	3,142	2,398	4,186	7,713	3,790
	State	485	13,434	8,605	14,405	19,587	10,920

NA-Not Available
[1]HBG-Hills of the Bluegrass Subarea (I)
BG -Bluegrass Subarea (II)
MCF-Mountains and Coalfield Subarea (III)
Basin-Kentucky River Basin
State-Kentucky

[2]Irrigated land is reported in acres not acres (000)

Note: Due to rounding, the totals may not equal the sum of the subareas.

Source: Bureau of Census, Census of Agriculture

Subarea III, the Mountains and Coalfield section, has only 423,700 acres or 19 percent of the area in farms. In 1974, this subarea contained 3,168 farms with an average size of 134 acres. Cropland and pastureland accounted for 31 percent of the land in farms, woods 53 percent, and other uses 16 percent.

Water Use

Major water uses are for domestic, industrial, and agricultural purposes. Principal domestic and industrial users of water are the larger populated centers that obtain the major portion of their water supply from the Kentucky River or its tributaries. Most of the larger populated centers include Lexington and satellite towns in the Bluegrass, Frankfort in the lower section, and Hazard and Jackson in the upstream area.

As previously noted, the Kentucky River is the major surface water supply source. Most municipal and industrial withdrawals from the river are for towns extending from Beattyville through Frankfort. The Kentucky American Water Company is the largest municipal and rural supplier that obtains water from the Kentucky River. This company, which provides water for Lexington, withdrew an average of 26.8 mgd in 1975.

Major industrial users of water are the electric power generating plants and the distilleries. Herrington Lake and the Kentucky River are the primary sources of water for the steam- or hydro-generating plants. Most of the water withdrawals are used for cooling purposes and are then returned to the river. The Tyrone steam-generating plant at Lawrenceburg, which averages about 188 mgd, is the largest industrial withdrawer from the Kentucky River. Three distilleries in Frankfort and one in Lawrenceburg average withdrawing almost 7 million gallons per day.

Agricultural use of water is mainly for livestock, irrigation, tobacco plant beds and for transplanting tobacco. Of these, farm animals and irrigation use the largest quantity, approaching 20 million gallons per day for livestock and around 0.4 acre feet of water per acre irrigated. In 1974, about 3,700 acres, principally tobacco, were irrigated. Farm ponds and tributary streams provide most of the agricultural water.

As earlier noted, the Kentucky River has a series of 14 locks and dams that afford slack water navigation. A part of the Ohio River navigation system, the navigable waters extend from the confluence of the Kentucky with the Ohio River to Beattyville, about 289 miles upstream. A minimum navigable depth of 6 feet is maintained by the system. The shallow depth, coupled with the dimensions of some locks or dams, makes the system unsuited for most commerical traffic. It is suitable and extensively used for pleasure and recreational boating.

Kentucky River and the three lake areas, Herrington, Buckhorn, and Carr Fork, provide most of the recreational water. These areas provide for water-oriented recreation activities, including fishing, skiing, swimming, and boating. In addition to boat docks and launching facilities, camping and picnicking areas are provided at many sites. Recreational water use on the tributary streams is mostly for fishing and boating.

Agricultural Production

Principal crops produced in the basin are tobacco, corn, and hay. Of these, tobacco is the major cash crop, accounting for over two-thirds of the total value of all crops produced. In 1974, the area had about 66,000 acres of corn for grain, 210,000 acres of hay, and 46,000 acres of tobacco (table A.11). Production amounted to 5.2 million bushels of corn, 387,000 tons of hay and grass silage, and 105 million pounds of tobacco (table A.12). The value of these and other crops produced amounted to over $1.2 billion in that year (table A.13). Beef and dairy cattle, the principal livestock produced in the area, totaled over 500,000 head in 1974 (table A.14). Value of the cattle and other livestock exceeded $83 million in that year.

Subarea I - Principal crops produced in Subarea I are tobacco, corn, and hay. The subarea accounted for about 25 percent of the basin's crop acreage and market value of crops in 1974. This area also has about one-fourth of the livestock numbers in the basin.

Subarea II - The Bluegrass, or Subarea II, is by far the major agricultural section. This area accounted for two-thirds of both the acreage and quantity of corn, hay, and tobacco produced in the basin. In 1974, the value of these and other farm crops amounted to $78.2 million, or 65 percent of total

Table A.11--Harvested acreage of major crops by subarea, basin, and state for selected years
Kentucky River Basin

Crop	Region[1]	All Farms 1949	1954	1959	1964	1969	1974
				-Acres (000)-			
Field corn (grain)	HBG	36.3	30.6	26.4	13.2	11.1	13.4
	BG	78.9	69.8	67.6	39.4	32.9	41.3
	MCF	86.3	60.5	40.6	15.4	6.8	11.3
	Basin	201.5	160.9	134.6	68.0	50.8	66.0
	State	2,152.7	1,864.8	1,581.3	980.8	864.8	975.4
Field corn (silage)	HBG	NA	2.7	2.4	3.0	NA	NA
	BG	NA	6.8	6.0	7.1	NA	NA
	MCF	NA	0.2	0.2	0.4	NA	NA
	Basin	NA	9.8	8.6	10.5	NA	NA
	State	26.7	65.4	47.5	76.6	NA	NA
Hay & Grass silage[2]	HBG	67.1	59.6	62.2	66.8	57.9	57.8
	BG	120.1	115.6	134.0	145.5	127.9	136.3
	MCF	36.1	34.1	25.3	21.1	15.4	15.6
	Basin	223.3	209.3	221.5	233.4	200.2	209.6
	State	1,682.8	1,446.0	1,471.0	1,556.1	1,280.3	1,308.7
Tobacco	HBG	21.8	18.1	14.2	14.2	10.8	12.8
	BG	48.0	40.4	32.5	32.0	25.3	29.5
	MCF	7.1	6.5	5.1	4.8	3.6	3.6
	Basin	76.9	65.0	51.8	51.0	39.7	45.9
	State	323.7	277.3	211.7	210.4	162.3	179.1
All wheat	HBG	6.1	3.6	0.8	0.9	0.7	1.6
	BG	17.1	10.6	5.1	4.1	2.6	5.4
	MCF	0.3	0.2	*	*	*	*
	Basin	23.5	14.4	5.9	4.9	3.4	7.0
	State	208.6	209.5	158.4	153.0	156.6	331.4
Soybeans	HBG	0.4	0.1	0.1	0.1	0.2	0.7
	BG	0.1	0.1	0.1	0.1	0.1	0.9
	MCF	0.1	*	*	*	*	*
	Basin	0.6	0.2	0.3	0.2	0.3	1.6
	State	131.9	126.6	181.0	236.1	391.5	874.6

NA-Not Available *-less than 50 acres
[1]HBG-Hills of the Bluegrass Subarea BG-Bluegrass Subarea
MCF-Mountains and Coalfield Subarea Basin-Kentucky River Basin
State-Kentucky
[2]Excludes soybean, peanut, cowpea hays.
Note: Due to rounding, basin totals may not equal the sum of the subareas.
Source: Bureau of Census, Census of Agriculture

Table A.12--Production of major crops
by subarea, basin, and state for selected years
Kentucky River Basin

Land Use	Unit of Production	Region[1]	All Farms 1949	1954	1959	1964	1969	1974
Field corn (grain)	Bu. (000)	HBG	1,432	1,071	1,305	709	846	999
		BG	3,494	2,808	3,435	2,255	2,614	3,505
		MCF	2,310	1,903	1,495	696	446	547
		Basin	7,236	5,783	6,234	3,660	3,906	5,151
Field Corn (silage)	Tons, green	HBG	NA	21,978	23,202	36,047	NA	NA
		BG	NA	65,704	70,083	102,882	NA	NA
		MCF	NA	1,863	2,112	4,310	NA	NA
		Basin	NA	89,545	95,397	143,239	NA	NA
		State	250,412	499,195	513,481	1,022,297	NA	NA
Hay & grass silage	Tons, dry	HBG	85,459	75,797	93,517	119,214	104,525	105,545
		BG	157,720	150,048	196,458	224,589	226,494	258,253
		MCF	38,029	34,303	26,397	22,953	21,782	23,000
		Basin	281,208	260,148	316,372	366,756	352,801	386,798
		State	2,117,956	1,697,223	2,140,913	2,355,160	2,250,232	2,421,976
Tobacco	Lb. (000)	HBG	28,003	27,232	24,195	26,069	27,851	30,332
		BG	66,588	64,665	54,115	59,727	65,573	67,980
		MCF	8,878	9,629	7,727	9,131	7,661	6,919
		Basin	103,469	101,526	86,037	94,927	101,085	105,231
		State	404,881	411,726	355,099	396,115	375,549	388,148
All wheat	Bu. (000)	HBG	121	87	17	25	23	51
		BG	331	258	107	110	82	167
		MCF	4	3	1	1	1	*
		Basin	456	348	124	136	106	218
		State	4,491	5,161	3,877	4,908	5,272	10,460

Table A.12--Production of major crops
by subarea, basin, and state for selected years (cont.)
Kentucky River Basin

Land Use	Unit of Production	Region[1]	All Farms 1949	1954	1959	1964	1969	1974
Soybeans	Bu. (000)	HBG	6	2	3	2	5	22
		BG	1	2	3	2	3	[2] 23
		MCF	1	*	2	1	1	1
		Basin	8	4	7	5	9	46
		State	2,266	2,102	4,015	5,166	10,614	21,567

NA-Not available *less than 500 units

[1] HBG-Hills of the Bluegrass Subarea
BG-Bluegrass Subarea
MCF-Mountains and Coalfield Subarea
Basin-Kentucky River Basin
State-Kentucky

[2]Due to disclosure restrictions, production for Woodford County was calculated by multiplying the reported acreage times the average yield for the seven other counties of the Bluegrass Subarea.

Note: Due to rounding, basin totals may not equal the sum of the subareas.

Source: Bureau of Census, Census of Agriculture

Table A.13--Market value of agricultural products
by subarea, basin, and state for selected years
Kentucky River Basin

Product	Region[1]	All Farms 1949	1954	1959	1964	1969	1974
				- dollars (000) -			
All agricultural products	HBG	20,870	20,680	25,560	26,044	33,150	50,036
	BG	61,458	57,941	69,783	78,303	99,707	142,850
	MCF	7,080	7,546	7,865	8,503	8,618	12,871
	Basin	89,408	86,167	103,208	112,850	141,476	205,757
	State	417,061	424,654	518,070	591,598	769,858	1,251,853
Crops	HBG	12,829	14,286	15,299	16,836	19,499	33,947
	BG	34,357	35,342	35,266	39,174	46,855	78,267
	MCF	4,332	5,905	5,358	6,241	5,733	8,706
	Basin	51,518	55,533	55,923	62,250	72,087	120,920
	State	207,463	255,424	249,232	208,773	343,204	729,747
Forest	HBG	30	18	34	29	61	47
	BG	107	62	155	144	220	72
	MCF	345	152	105	114	126	128
	Basin	482	232	294	288	407	247
	State	3,199	1,864	3,476	3,436	4,046	5,030
Livestock, Poultry and their products	HBG	8,010	6,376	10,227	9,122	13,590	16,005
	BG	26,994	22,536	34,362	38,932	52,632	64,236
	MCF	2,403	1,490	2,402	2,133	2,759	2,948
	Basin	37,408	30,402	46,991	50,198	68,981	83,189
	State	206,399	167,366	265,362	278,914	422,607	517,076

[1] HBG - Hills of the Bluegrass Subarea
BG - Bluegrass Subarea
MCF - Mountains and Coalfield Subarea
Basin - Kentucky River Basin
State - Kentucky

Source: Bureau of Census, Census of Agriculture

Table A.14--Livestock and poultry inventory by subarea, basin, and state for selected years
Kentucky River Basin

		All Farms					
	Region[1]	1949	1954	1959	1964	1969	1974
		Number of animals x 1,000					
Cattle and calves	HBG	71	67	82	88	101	118
	BG	187	165	213	249	308	362
	MCF	41	37	29	30	26	33
	Basin	299	270	324	368	435	513
	State	1,652	1,672	1,947	2,341	2,592	3,033
Cattle and calves other than milk cows	HBG	39	41	60	71	87	106
	BG	139	133	186	229	292	349
	MCF	19	19	19	22	24	31
	Basin	197	192	265	323	403	486
	State	1,015	1,115	1,481	1,934	2,286	2,727
Pigs and hogs	HBG	41	23	35	20	19	11
	BG	109	64	112	64	71	45
	MCF	37	27	31	15	9	13
	Basin	187	114	179	100	99	69
	State	1,530	1,060	1,653	1,098	1,251	898
Chickens	HBG	241	221	202	93	29	15
	BG	518	448	331	171	212	146
	MCF	480	463	297	200	119	44
	Basin	1,239	1,132	830	464	361	205
	State	8,175	7,566	5,472	3,787	3,208	2,810
Sheep and lambs	HBG	68	41	43	14	9	4
	BG	233	124	139	53	36	13
	MCF	4	2	2	1	*	1
	Basin	305	167	184	68	46	18
	State	982	536	546	184	119	44

[1] HBG - Hills of the Bluegrass Subarea
BG - Bluegrass Subarea
MCF - Mountains and Coalfield Subarea
Basin - Kentucky River Basin
State - Kentucky

* - less than 500 animals

Note: Due to rounding, basin totals may not equal the sum of the subareas.

Source: Bureau of Census, Census of Agriculture

value of crops in the basin. The Bluegrass had over 362,000 cows and calves, and the value of all livestock amounted to $64 million.

Subarea III - Agriculture in the Mountains and Coalfield, Subarea III, has never been a dynamic industry largely because of lack of a suitable land resource base. Most of the farm operations are in the valleys, with some being on the undulating uplands. Many of the areas are small, inconveniently located, and less productive than the less steep lands in the other sections. Because of these and related factors, many of the farms have insufficient resources for an efficient operating unit.

In 1974, the Mountains and Coalfield area had about 20 percent of the basin farms and 17 percent of the land in farms. However, the area accounted for less than 10 percent of the quantity of crops produced, livestock numbers, and value of farm products sold.

Industrial Influence and Employment

Major industries in terms of employment are wholesale and retail trade, services, and manufacturing. In 1977, these industries accounted for 77 percent of the nonagricultural employment reported for the 24 study area counties (table A.15).[4] Employment in the area totaled approximately 265,000 in 1977 and included about 17,000 in agricultural, 165,000 in nonagricultural activities, and almost 83,000 in domestic and other nonspecified jobs.

Subarea I - As shown in table A.15, the lower section of the basin, subarea I, contained 11 percent of the nonagricultural workers and 22 percent of the agricultural workers. Principal nonagricultural industries are manufacturing, services, and wholesale and retail trade. These industries accounted for 84 percent of the nonagricultural employment.

Manufacturing in the subarea consists mainly of distilled beverages, metal and machinery products, chemicals, and clothing and apparel. In addition to the trade and service establishments in the towns and villages in the area, Frankfort, the state capital, is the principal employment center in the subarea.

Subarea II - The Bluegrass subarea provides almost three-fourths of the employment in the basin. In 1977, this area had about 178,000 workers, with 11,800 employed in agricultural and over 121,000 employed in nonagricultural activities. These workers exclude domestic and related workers listed in the preceding footnote. About 83 percent of the nonagricultural workers are in manufacturing, service, and trade industries. Principal employers are the University of Kentucky in Lexington, Eastern Kentucky University at Richmond; the electrical equipment, machinery, and metal industries; the burley tobacco markets and redrying plants; and the thoroughbred horse industry. Lexington is the largest metropolitan area, has the most industries and is the major trade center.

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[4]As included in the 1978 Kentucky Deskbook of Economic Statistics, published by the Kentucky Department of Commerce, nonagricultural employment reported excludes domestic workers, railway workers, certain nonprofit corporations; majority of federal, state, and local government workers; and self-employed workers, when these and agricultural are added to 164,808 nonagricultural workers, total employment in the basin is 264,683.

Table A.15--Employment by Industry or Place of Work, 1977
Kentucky River Basin

County and Subarea	Nonagricultural Employment by Industry & Place of Work[1]											
	Manufacturing	Wholesale & Retail Trade	Services	Mining & Quarrying	Contract Const.	Transp., Commun. & Public Util.	Fin., Ins. & Real Estate	Other	Non-Agri. Total	Agricultural	Other[3]	Grand Total
SUBAREA I												
Carroll	1,554	537	210	[2]	138	222	67	[2]	2,741	412	1,181	4,334
Franklin	3,376	2,729	4,720	[2]	849	484	449	53	12,680	522	4,928	18,130
Grant	77	641	226	0	73	92	99	[2]	1,212	529	2,705	4,446
Henry	435	435	141	[2]	67	76	97	[2]	1,264	1,247	2,421	4,932
Owen	195	211	54	0	74	90	70	[2]	701	961	1,772	3,434
Subtotal	5,637	4,553	5,351	0	1,201	964	782	53	18,598	3,671	13,007	35,276
SUBAREA II												
Clark	4,103	1,945	1,116	[2]	377	1,004	269	45	8,896	1,206	3,423	13,525
Fayette	17,505	24,832	25,871	286	5,620	4,626	5,363	390	84,493	2,882	9,725	97,100
Garrard	654	398	123	[2]	59	24	68	[2]	1,357	856	1,895	4,108
Jessamine	892	1,022	529	[2]	361	130	127	4	3,096	1,006	7,203	11,305
Lincoln	390	401	251	[2]	134	49	76	12	1,334	1,515	3,058	5,907
Madison	4,158	3,852	4,064	39	405	223	361	42	13,144	1,717	11,744	26,605
Scott	2,712	809	729	[2]	139	91	156	[2]	4,674	1,453	3,630	9,757
Woodford	2,828	677	588	0	164	89	137	55	4,537	1,163	2,972	8,672
Subtotal	33,242	33,936	33,271	325	7,259	6,236	6,557	548	121,531	11,798	43,650	176,979

Table A.15--Employment by Industry or Place of Work, 1977 (cont.)
Kentucky River Basin

County and Subarea	Nonagricultural Employment by Industry & Place of Work[1]											
	Manufacturing	Wholesale & Retail Trade	Services	Mining & Quarrying	Contract Const.	Transp., Commun. & Public Util.	Fin., Ins. & Real Estate	Other	Non-Agri. Total	Agricultural	Other[3]	Grand Total
SUBAREA III												
Breathitt	158	588	350	444	56	159	84	3	1,842	202	3,854	5,898
Clay	301	599	550	1,434	52	152	65	[2]	3,155	337	2,902	6,394
Estill	635	385	203	269	63	64	51	0	1,670	99	4,420	6,189
Knott	17	351	320	817	70	104	18	0	1,697	57	2,509	4,263
Lee	20	200	134	205	19	50	[2]	[2]	658	34	988	1,680
Leslie	52	203	336	427	25	92	34	0	1,169	28	2,879	4,076
Letcher	171	916	749	3,307	76	201	131	0	5,280	16	1,804	7,100
Owsley	0	93	58	101	8	[2]	[2]	0	274	305	1,067	1,646
Perry	157	1,668	1,228	3,394	297	501	235	5	7,484	176	2,770	10,430
Powell	91	186	142	28	131	84	41	0	709	130	1,935	2,774
Wolfe	294	162	106	131	16	19	2	[2]	741	224	1,013	1,978
Subtotal	1,896	5,351	4,176	10,287	813	1,426	659	8	24,679	1,608	26,141	52,428
Total	40,775	43,840	42,798	10,612	9,273	8,626	7,998	609	164,808	17,077	82,798	264,683

[1]Nonagricultural employment may not add to the total because the number in other column is not disclosed.
[2]Not disclosed.
[3]Includes domestic workers, railway workers, certain nonprofit corporations; majority fo federal, state and local government workers; and self-employed workers.

Source: Kentucky Deskbook of Economic Statistics, 1978, Kentucky Department of Commerce.

Subarea III - Coal mining, the major industry in the Mountains and Coalfield Subarea, provided 42 percent of the nonagricultural employment in 1977. Trade and service activities accounted for 39 percent of the reported employment. Together, the three activities provided four-fifths of the nonagricultural employment in the 11-county subarea. Of the 52,428 workers in the area, 1,600 were in agriculture and 26,100 were in domestic and other jobs (table A.15).

POPULATION

Population estimates for the 24-county area show the 1977 population at 601,000. This represents a 12 percent increase over the 1970 count of 534,095 and 23 percent above the 1960 level of 487,800. The 12 and 23 percent growth rates exceeded the 9 and 13 percent rates for the state for the two time periods. Three counties, Fayette with 189,900, Madision with 48,400 and Franklin with 38,600, account for 46 percent of the area's population. The larger populated centers are Lexington with 186,000; Frankfort with 22,900; Richmond with 19,200; Winchester with 16,000; and Georgetown with 8,900. In 1970, the population was about equally divided between urban and rural.

Subarea I - The 1977 estimates show the population in Subarea I at 79,600, a 22 percent increase above the 1960 level and 12 percent above 1970 (table A.16). All counties experienced an increase over 1970, with Grant and Owen having the largest gain. Prior to the 1970 increases, population was declining in all counties, except Franklin. Approximately two-thirds of the population was classified as being rural in 1970.

Per capita income in the five county subarea averaged about $5,750 in 1977 (table A.17). This is 190 percent above the 1970 average of $3,000 and over four times greater than the $1,400 average for 1960. Per capital income averaged the highest in Franklin County and the lowest in Owen.

Subarea II - The eight-county Bluegrass Subarea (II) is the dominant population area, accounting for about 59 percent of the total population in the basin (table A-18). In the 17-year period from 1960 to 1977, population increased from 253,627 to 352,000, a 39 percent gain.

All Subarea II counties, except Garrard, experienced population increases. Since 1960, population in Fayette County increased 44 percent or 58,000 persons. Most of the population growth in this county can be attributed to the high rates of immigration which reflects the desirability of the educational and employment opportunities in the Fayette county area.

Population in the Bluegrass subarea has become increasingly urban and increasingly concentrated in the Lexington metropolitan area. From 1960 to 1970, the urban population increased by 64,000 while the rural segment remained about the same. In 1970, this population in Fayette County was classed as being 92 percent urban and 8 percent rural. This urbanized county also accounted for 71 percent of the urban population in the subarea and about 59 percent of the total population in the eight county subarea.

Table A.16--Population and rural-urban composition for Subarea I
by county, basin, and state for selected years
Kentucky River Basin

County	Population			Urban		Rural	
	1960	1970	1977[1]	1960	1970	1960	1970
Carroll	7,978	8,523	8,700	3,215	3,886	4,763	4,637
Franklin	29,421	34,481	38,600	18,359	21,344	11,062	13,137
Grant	9,489	9,999	12,200	--	--	9,489	9,999
Henry	10,987	10,910	11,600	--	--	10,987	10,910
Owen	8,237	7,470	8,500	--	--	8,237	7,470
Total	66,112	71,383	79,600	21,574	25,230	44,538	46,153
Basin	487,806	534,095	601,000	193,411	260,037	294,395	274,058
State	3,038,156	3,218,156	3,458,000	1,351,979	1,685,445	1,686,177	1,533,261

[1]Estimates.

Source: U.S. Department of Commerce, Bureau of the Census, and 1978 Kentucky Deskbook of Economic Statistics, Kentucky Department of Commerce.

Table A.17--Per Capita Income, Subarea I, for Selected Years. Kentucky River Basin

County	Years		
	1960	1970	1977
		- Dollars -	
Carroll	1,456	2,913	6,005
Franklin	1,981	3,590	6,842
Grant	1,144	2,899	5,417
Henry	1,209	2,949	5,715
Owen	1,149	2,679	4,762

Source: Kentucky Department of Commerce

Per capita income in this subarea averaged about $5,850 in 1977. Fayette and Woodford counties had average incomes in excess of $7,000 while Lincoln had the lowest, at $4,100 (table A.19). The $5,850 average for 1977 was almost double the 1970 average and 3.75 times greater than the 1960 average.

Subarea III - Population in the Mountains and Coalfield Region totaled about 169,000 in 1977, approximately 16 percent greater than the 1970 level (table A.21). The recent gains in population reversed a declining trend that began more than four decades past and accelerated during and after World War II. The decline resulted primarily from outmigration of the younger and lower middle age groups to the more industrialized areas. The recent reversal of the decline is largely attributable to the rejuvenated coal mining industry and the decline in favorable employment opportunities in industralized centers.

All counties in the subarea experienced decreases in population until the mid seventies. The most pronounced decreases were in Perry and Letcher, two of the principal coal producing counties. Although moderate, these counties, along with Knott and Breathitt, are experiencing the greatest population growth. Despite the reversal of the population decline, the area is sparsely populated, averaging slightly over 15,000 inhabitants per county. In 1970, over 90 percent of the population was classed as rural.

Per capita income in the 11-county area is considerably lower than in the other 2 basin subareas. Personal incomes in Perry, Letcher, and Estill amounts compare favorably with average incomes received by other subarea workers. However, annual per capita incomes for the other mountainous counties were about $2,000 below the average in the central and lower Bluegrass counties. As shown in table A.20, per capita income averaged less than $1,000 in 1960, less than $2,000, in 1970, $4,000 in 1977.

Table A.18--Population and rural-urban composition for Subarea II
by county, basin, and state for selected years
Kentucky River Basin

County	Population			Urban		Urban	
	1960	1970	1977[1]	1960	1970	1960	1970
Clark	21,675	24,090	26,300	10,179	13,394	10,896	10,696
Fayette	131,906	174,343	189,900	111,988	159,854	19,918	14,469
Garrard	9,747	9,457	9,780	3,022	3,291	6,725	6,166
Jessamine	13,625	17,430	23,000	7,044	9,255	6,581	8,175
Lincoln	16,503	16,663	18,300	--	--	16,503	16,663
Madison	33,482	42,730	48,400	16,473	23,801	17,009	18,929
Scott	15,376	17,948	19,700	6,981	8,633	8,395	9,315
Woodford	11,913	14,434	16,700	4,062	5,673	7,851	8,761
Totals	253,627	317,075	352,000	159,749	223,901	93,878	93,174
Basin	487,806	534,095	601,000	193,411	260,037	294,395	274,058
State	3,038,156	3,218,706	3,458,000	1,351,979	1,685,445	1,686,177	1,533,261

[1]Estimates
Source: U.S. Department of Commerce, Bureau of the Census, and 1978 Kentucky Deskbook of Economic Statistics, Kentucky Department of Commerce.

Table A.19--Per Capita Income, Subarea II, for Selected Years. Kentucky River Basin

County	Years		
	1960	1970	1977
		- Dollars -	
Clark	1,752	3,430	6,806
Fayette	2,167	3,844	7,221
Garrard	1,263	2,898	5,924
Jessamine	1,474	2,519	4,844
Lincoln	834	2,198	4,103
Madison	1,392	2,505	4,868
Scott	1,535	2,854	6,007
Woodford	1,989	4,020	7,027

Source: Kentucky Department of Commerce.

Table A.20--Per Capita Income, Subarea III, for Selected Years. Kentucky River Basin

County	Years		
	1960	1970	1980
		- Dollars -	
Breathitt	641	2,535	3,345
Clay	627	1,526	3,547
Estill	660	2,105	4,826
Knott	514	1,365	3,506
Lee	744	1,652	3,406
Leslie	1,101	1,288	3,751
Letcher	1,215	2,448	4,912
Owsley	599	1,360	2,747
Perry	1,175	2,327	5,611
Powell	676	2,082	4,142
Wolfe	523	1,492	3,523

Source: Kentucky Department of Commerce

Table A.21--Population and rural - urban composition for Subarea III
by county, basin, and state for selected years
Kentucky River Basin

County	Population			Urban		Urban	
	1960	1970	1977[1]	1960	1970	1960	1970
Breathitt	15,490	14,221	17,200	--	--	15,490	14,221
Clay	20,748	18,481	21,900	--	--	20,748	18,481
Estill	12,466	12,752	13,500	2,954	2,907	9,512	9,845
Knott	17,362	14,698	17,700	--	--	17,362	14,698
Lee	7,420	6,587	7,300	--	--	7,420	6,587
Leslie	10,941	11,623	13,300	--	--	10,941	11,623
Letcher	30,102	23,165	27,700	3,191	2,548	26,911	20,617
Owsley	5,369	5,023	5,600	--	--	5,369	5,023
Perry	34,961	25,714	29,700	5,943	5,451	29,018	20,263
Powell	6,674	7,704	9,100	--	--	6,674	7,704
Wolfe	6,534	5,669	6,400	--	--	6,534	5,669
Totals	168,067	145,637	169,400	12,088	10,906	155,979	134,731
Basin	487,806	534,095	601,000	193,411	260,037	294,395	274,058
State	3,038,156	3,218,706	3,458,000	1,351,979	1,685,445	1,686,177	1,533,261

Source: U.S. Department of Commerce, Bureau of the Census, and 1978 Kentucky Deskbook of Economic Statistics, Kentucky Department of Commerce.

APPENDIX B-SUPPORTING DATA

Appendix B Table I.1--Principal towns or communities with flood water problems
Kentucky River Basin

County	Town or Community	Source of Flooding	Subbasin or Basin
Boyle	Danville	Clarks Run	Kentucky
Breathitt	Jackson and adjoining communities	N. Fork of Ky. River Lost Creek Troublesome Creek	North Fork
Carroll	Sanders	Eagle Creek	Kentucky
Clark	Winchester	Lower Howard Creek	Kentucky
Clay	Hima-Sibert Oneida, Manchester	Horse Creek Goose Creek	South Fork South Fork
Estill	Irvine, Ravenna	Kentucky River Sweet Lick Creek	Kentucky
Fayette	Lexington	Town Branch, South Elkhorn, West Hickman	Kentucky
Franklin	Frankfort Peaks Mill Forks of Elkhorn	Kentucky River S. Fork of Elkhorn Fork of N.-S. Elkhorn	Kentucky Kentucky Kentucky
Gallatin	Sparta	Eagle Creek	Kentucky
Garrard	Paint Lick Camp Nelson	Paint Lick-Ky. River Kentucky River	Kentucky Kentucky
Jessamine	Camp Nelson, High Bridge	Kentucky River	Kentucky
	Valley View, Union Mill	Kentucky River	Kentucky
	Wilmore, Nicholasville	Jessamine Creek	Kentucky
Knott	Hindman, Emmalena, Amburgy, and others	Troublesome, Irishman and Balls Fork Creek	N. Fork North Fork
Lee	Beattyville, Heidelburg	N-S Forks, Ky. River	Junction of Forks
Leslie	Hyden	Middle Fork, Ky. River	Kentucky
Letcher	Whitesburg, Neon	North Fork, Ky. River	North Fork
	Jeremiah, Blackey	North Fork, Ky. River	N. Fork
	and other communities	Rockhouse Creek	

Appendix B Table I.1--Principal towns or communities with flood water problems (cont.).
Kentucky River Basin

County	Town or Community	Source of Flooding	Subbasin or Basin
Lincoln	Rowland	Logan	Kentucky
Madison	Kingston, Hays Fork	Silver Creek	Kentucky
	Valley View	Kentucky River	Kentucky
Mercer	Burgin	Burgin Creek	Kentucky
Owen	Sparta	Eagle Creek	Kentucky
	Monterey, Gratz	Kentucky River	Kentucky
Owsley	Booneville	S. Fk. of Ky River	South Fork
Perry	Hazard, Combs, Chavies	N. Fk. of Ky River	North Fork
Powell	Clay City, Stanton	Red River	Kentucky
Wolfe	Campton	Swift Camp	Kentucky
Woodford	Faywood, Davistown	S. Elkhorn Creek	Kentucky

Source: Compiled by SCS from secondary and primary data on flooding and from Type 21, Flood Insurance Study.

Appendix B Table I.2--Inventory Data - Kentucky River Basin

	Sub-Basin and Watershed	Delineated Number[1]	Watershed Area[2]	Acres Flooding		Location Counties
				Agriculture	Urban	
			(acres)			
I.	NORTH FORK OF KENTUCKY RIVER					
1.	Upper North Fork of Kentucky River	14a-1	84,224	1,200	100	Letcher
2.	Rockhouse Creek	14a-2	36,022	1,000	10	Letcher
3.	Line Fork Creek	14a-3	41,792	900	--	Letcher
4.	Leatherwood Creek	14a-100	33,000	792	--	Perry
5.	Maces Creek	14a-101	17,000	408	10	Perry
6.	Irishman Creek	14a-102	37,248	893	10	Knott
7.	Big Creek	14a-103	14,000	336	--	Perry
8.	Carr Fork	14a-104	48,944	868	190	Letcher, Knott, Perry
9.	Lotts Creek	14a-7	19,584	468	--	Perry, Knott
10.	Troublesome Creek	14a-8	157,440	4,430	20	Perry, Breathitt, Knott
11.	Grapevine Creek	14a-12	9,088	218	--	Perry
12.	Middle North Fork of Kentucky River	14a-105	68,048	2,860	35	Perry, Breathitt
13.	South Fork of Quicksand Creek	14a-9	26,880	884	10	Breathitt
14.	Quicksand Creek	14a-10	129,280	3,683	--	Breathitt, Knott
15.	Cane Creek	14a-13	13,184	250	--	Breathitt
16.	Frozen Creek	14a-14	36,968	1,341	--	Breathitt
17.	Johnson Fork	14a-107	14,000	317	--	Breathitt
18.	Lower North Fork of Kentucky River	14a-106	3,448	290	40	Breathitt
19.	Holly Creek	14a-108	15,000	100	--	Wolfe
20.	Swift Camp Creek	14a-109	14,000	25	30	Wolfe
21.	Lower Devil Creek	14a-100	14,000	100	--	Wolfe, Lee
22.	Wallers Creek	14a-111	12,000	100	--	Lee, Wolfe
	Subtotal		845,150	21,464	455	

Appendix B Table I.2--Watershed Inventory Data - Kentucky River Basin (cont.)

Sub-Basin and Watershed	Delineated Number[1]	Watershed Area[2]	Acres Flooding		Location Counties
			Agriculture	Urban	
		(acres)			
II. SOUTH FORK OF KENTUCKY RIVER					
1. Redbird River	14b-1	125,440	4,238	10	Leslie, Clay, Bell
2. Goose Creek	14b-2	157,888	3,160	30	Clay
3. Bullskin Creek	14b-3	19,072	845	--	Clay, Leslie
4. Sexton Creek	14b-4	36,352	987	--	Clay, Owsley
5. Middle South Fork of Kentucky River	14b-117	100,288	2,378	40	Owsley, Clay
6. Meadow Creek	14b-5	11,328	1,756	--	Owsley, Breathitt
7. Lower South Fork of Kentucky River	14b-118	28,352	3,118	50	Lee, Owsley
Subtotal		478,720	16,482	130	
III. KENTUCKY RIVER					
1. Upper Red River	14-6	44,544	1,210	10	Wolfe, Morgan
2. Upper Red River	14-7	13,376	300	--	Wolfe
3. Upper Red River	14-8	37,184	2,000	--	Powell, Wolfe
4. Upper Red River	14-9	8,832	904	--	Montgomery, Menifee
5. Sturgeon Creek	14-12	71,040	2,150	20	Lee, Jackson
6. Millers Creek	14-13	47,168	1,300	--	Estill, Lee
7. Station Camp Creek	14-14	92,758	4,162	--	Jackson, Owsley
8. Cow Creek	14-15	11,136	450	--	Estill
9. Silver Creek	14-20	76,160	4,427	30	Madison
10. Paint Lick Creek	14-21	54,336	2,750	35	Garrard, Madison
11. Logan Creek	14-22	16,000	800	45	Lincoln
12. Hanging Fork	14-23	61,312	2,852	30	Lincoln, Boyle
13. Hickman Creek	14-27	63,680	1,520	40	Fayette, Jessamine
14. Clear Creek	14-30	40,982	608	--	Woodford, Jessamine
15. Benson Creek	14-33	68,480	4,210	175	Franklin, Anderson

Appendix B Table II.2--Watershed Inventory Data - Kentucky River Basin (cont.)

Sub-Basin and Watershed	Delineated Number[1]	Watershed Area[2]	Acres Flooding		Location Counties
			Agriculture	Urban	
		(acres)			
III. KENTUCKY RIVER (cont.)					
16. Flat Creek	14-34	14,400	535	10	Shelby, Franklin
17. Six Mile Creek	14-36	52,224	1,001	10	Henry, Shelby
18. Upper Eagle Creek	14-37	70,656	5,096	5	Harrison, Owen
19. Drennon Creek	14-38	49,920	4,040	--	Henry, Shelby
20. Big Twin Creek	14-39	23,232	3,000	--	Owen
21. Upper Middle Fork Kentucky River	14-112	148,480	3,516	10	Harlan, Leslie
22. Gutskin Creek	14-113	59,008	1,440	--	Leslie
23. Elkhorn Creek	14-114	53,632	544	--	Leslie, Perry
24. Long Creek	14-115	18,000	542	--	Perry, Breathitt
25. Lower Middle Fork Kentucky River	14-116	78,640	1,948	--	Breathitt, Perry
26. Red Lick Creek	14-119	44,760	5,039	--	Madison, Estill
27. Middle Red River	14-121	82,240	475	--	Menifee, Powell
28. Lower Red River	14-122	78,504	15,680	70	Montgomery, Estill Menifee
29. Hardwick Creek	14-123	15,000	2,500	--	Powell
30. Lulbegrud Creek	14-124	22,000	1,143	--	Montgomery, Powell
31. Drowning Creek	14-125	26,000	575	--	Madison, Estill
32. White Oak Creek	14-126	10,000	220	--	Estill
33. Muddy Creek	14-128	36,000	4,811	35	Madison
34. Upper Howard Creek	14-129	30,000	975	--	Clark
35. Four Mile Creek	14-130	21,000	672	--	Clark
36. Otter Creek	14-131	4,800	2,380	30	Madison
37. Lower Howard Creek	14-132	15,000	75	60	Clark
38. Bauman Fork	14-133	28,000	454	--	Fayette, Clark
39. Tate Creek	14-134	25,000	685	40	Madison
40. Sugar Creek	14-136	24,000	225	--	Garrard
41. Jessamine Creek	14-137	28,000	450	20	Jessamine
42. Upper Dix River	14-138	110,000	7,497	60	Lincoln, Rockcastle, Garrard
43. Clarks Run	14-139	24,000	626	15	Boyle
44. Mocks Branch	14-140	13,000	260	--	Boyle

Appendix B Table II.2--Watershed Inventory Data - Kentucky River Basin (cont.)

Sub-Basin and Watershed	Delineated Number[1]	Watershed Area[2]	Acres Flooding		Location Counties
			Agriculture	Urban	
		(acres)			
III. KENTUCKY RIVER (cont.)					
45. Herrington Lake	14-141	58,568	1,212	--	Mercer, Garrard, Boyle, Lincoln
46. Shaker Creek	14-142	20,000	23	5	Mercer
47. Craig Creek	14-144	12,000	115	--	Woodford
48. Glenns Creek	14-145	25,000	607	120	Woodford, Franklin
49. South Fork Elkhorn	14-146	119,680	4,320	40	Franklin, Woodford, Jessamine, Fayette, Scott
50. North Fork Elkhorn	14-147	176,640	14,861	70	Franklin, Fayette, Scott
51. Lower South Elkhorn	14-148	23,680	2,311	200	Owen, Franklin, Scott
52. Sandridge Creek	14-150	33,000	2,500	--	Owen
53. Severn Creek	14-151	22,000	600	--	Owen
54. Lower Eagle Creek	14-152	116,224	4,097	--	Scott, Owen, Grant
55. Clarks Creek	14-153	23,000	250	--	Grant
56. Ten Mile Creek	14-154	46,600	1,175	--	Grant, Kenton, Boone, Gallatin
57. Brush Creek	14-155	18,000	150	--	Owen, Grant
58. Eagle Creek	14-156	58,280	6,600	100	Carroll, Gallatin, Owen, Grant
59. Mill Creek	14-157	20,000	418	25	Henry, Carroll, Trimble
60. White Run	14-158	22,240	1,800	50	Carroll, Henry
61. - 66. Main Stem Kentucky River		426,974	22,529	950	Along Main Stem
Subtotal		3,134,370	159,615	2,310	
TOTAL BASIN		4,458,240	197,561	2,895	

[1]Delineated number refers to the watershed number in the 1970 Soil and Water Conservation Needs Inventory for Kentucky.

SOURCE: Watershed Inventory in 1970 Soil and Water Conservation Needs Inventory for Kentucky, completed and studied watersheds, and other secondary and primary data on flooding.

Appendix B Table II.2--Display of Annual Alternative Plan Effects - Year 2000
KENTUCKY RIVER BASIN

Accounts and Impacts	Units	Alternative Plans 1	2	3	4	5	6	7	8	9
		Actual Units								
ECONOMIC DEVELOPMENT ACCOUNT										
Value - Agriculture Prod										
Cash crops	dollars	175,756.8	194,179.6	179,447.6	175,240.8	175,756.8	175,756.8	175,756.8	175,756.8	175,756.8
Roughage crop	dollars	115,616.1	118,191.7	125,067.2	115,616.1	115,616.1	115,616.1	115,616.1	115,616.1	115,616.1
Value of forest products	dollars	5,900.0	13,900.0	5,800.0	6,100.0	6,100.0	5,900.00	5,900.0	5,900.0	5,900.0
TOTAL VALUE		297,272.9	326,271.3	310,314.8	296,956.9	297,472.9	297,272.9	297,272.9	297,272.9	297,272.9
Value of Livestock Product	dollars[1]	144,502.2	147,413.3	170,685.9	144,502.2	144,520.2	144,502.2	144,502.2	144,502.2	144,502.2
COSTS										
Cash crop production	dollars	104,305.8	112,738.1	105,555.9	102,992.7	103,923.2	104,164.8	104,360.9	104,719.0	104,220.3
Roughage costs	dollars	29,907.9	32,180.5	33,840.5	29,359.2	29,799.0	29,740.0	30,558.7	29,377.3	29,346.4
Forest products										
Region	dollars	155.9	1,302.8	155.9	792.6	260.1	155.9	155.9	155.9	155.9
Rest of nation	dollars	467.5	3,908.4	467.5	2,377.8	780.3	467.5	467.5	467.5	467.5
Other										
Region	dollars	315.0	517.5	477.4	751.2	550.7	315.0	315.0	1,042.6	166.4
Rest of nation	dollars	666.0	703.0	758.5	740.0	684.5	666.0	666.0	721.5	610.5
TOTAL COSTS										
Region	dollars	134,684.6	146,738.9	140,029.7	133,895.7	134,533.0	134,375.7	135,390.5	135,294.8	133,889.0
Rest of nation	dollars	1,133.5	4,611.4	1,226.0	3,117.8	1,464.8	1,133.5	1,133.5	1,189.0	1,078.0
NET EFFECTS	DOLLARS	161,454.8	174,921.0	169,059.1	159,943.4	161,634.1	161,763.7	160,748.9	160,789.1	162,305.9

[1]Value of livestock products shown but excluded from the total value of products produced.

Appendix B Table II.1--Display of Annual Alternative Plan Elements - Year 2000

Plan Elements[1]	Units	Alternatives 1	2	3	4	5	6	7	8	9
		Actual Units								
LAND TREATMENT										
Cropland										
Contouring	Acres	8,460	8,460	8,460	8,460	8,460	8,460	8,460	14,500	1,581
Stripcropping	Acres	12,120	12,120	12,120	16,720	12,120	12,120	12,120	21,100	830
Residue Management	Acres	18,320	18,320	18,320	18,320	18,320	18,320	18,320	20,500	1,931
Minimum Tillage	Acres	16,860	25,940	23,288	27,163	15,912	16,860	16,860	20,492	20,423
No Tillage	Acres	12,698	22,950	14,494	12,612	12,736	12,698	12,698	23,440	5,124
Permanent Cover	Acres	23,650	23,650	23,650	106,264	53,890	23,650	23,650	38,370	
Pasture										
Management Improvement	Acres	124,800	124,800	605,095	436,731	124,800	124,800	124,800	249,600	
Change in Land use	Acres	5,680	5,680	5,680	55,168	55,168	5,680	5,680	36,880	
Forest										
Timber Stand Improvement	Acres	56,800	946,000	56,800	56,800	56,800	56,800	56,800	56,800	56,800
Reforestation	Acres	71,200	202,400	71,200	121,200	121,200	71,200	71,200	71,200	71,200
Critical Area Stabilization										
Gully	Acres	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240
Streambank	Miles	40	40	40	80	40	40	40	80	40
Roadbank	Miles	200	200	200	400	200	200	200	400	200
Surface Mines (old)[2]	Acres	9,000	9,000	9,000	18,000	9,000	9,000	9,000	18,000	9,000
Surface Mines (new)[2]	Acres	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Drainage (Wet soils)										
Agricultural Land	Acres	6,076	12,478	11,208	6,311	8,564	6,076	6,076	6,076	
Farm Ponds	Number	755	755	1500	755	755	755	755	755	755
Surface Area	Acres	2,300	2,300	4,500	2,300	2,300	2,300	2,300	2,300	2,300
LAND USE										
Cropland	Acres	544,630	544,630	544,630	462,016	514,390	544,630	544,630	529,910	568,280
Pasture	Acres	1,071,310	1,071,310	1,071,310	1,052,304	999,930	1,071,310	1,071,310	1,086,030	1,047,660
Nonfederal Forest	Acres	2,276,600	2,276,600	2,276,600	2,378,220	2,378,220	2,276,600	2,276,600	2,276,600	2,276,600

[1]Plan elements are technical measures instituted to assist in implementing the alternative courses of action.
[2]Surface mine acreage includes 9,000 acres of "old" or previously mined land expected to be stabilized and reclaimed by the year 2000. The "new" acreage refers to the 72,000 acres projected to be disturbed by mining activities between now and the year 2000.

APPENDIX C-GLOSSARY

Chisel Plowing: A soil tillage which breaks and loosens the top 4 to 15 inches of soil without inversion. The practice leaves 50 to 90 percent of preceding crop residues on the surface to help control erosion.

Conservation Needs Inventory (CNI)[1]: An inventory of agricultural land and associated rural areas based upon a statistical sampling of land and water resources. The inventory includes information of soil characteristics, soil problems and needs for treatment, and land use by crop types for counties, states, and hydrologic regions.

(a) CNI inventory acres - The grouping of agricultural land uses for data collection and aggregation. The groups are cropland, pasture, forest, and other (which includes non-federal rural land not classified as one of the preceding or as urban and built-up areas).

(b) CNI class (land capability class) - The broadest category in the capability classification technique. It consists of eight classes of soil with the risk of soil damage or limitations in use progressively increasing from Class I to Class VIII.

(c) CNI Subclass (land capability subclass) - The subdivision of class based on the kind of soil limitation or hazard. The four types recognized are: 1. erosion hazard (e); 2. wetness (w); 3. soil limitation in the root zone (s); and 4. adverse climate (c).

(d) Row crops - Corn, sorghum, soybeans, tobacco, vegetables, strawberries, potatoes, and all other cultivated crops.

(e) Close grown - Wheat, oats, other small grains, and other close seeded crops not usually grown in rows and tilled.

(f) Rotation hay and pasture - Grasses or legumes used for hay or pasture as part of the crop rotations. This must be used for field crops at least one year in seven.

(g) Hayland - Land permanently used for forage on which occasional seedbed preparation or other measures are used to improve the stand; other perennial grasses and legumes from which hay or seed is harvested and then pastured or allowed to grow forage.

(h) Other cropland - The residual of total cropland less categories defined in 1d through 1g. This includes land in conservation use, idle land, orchards, vineyards, and bush fruit.

(i) Pasture - Land in grasses or other long-term forage growth that is used primarily for grazing. This does not include rotation pasture, haylands or cropland of any category listed above.

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[1]National Inventory of Soil and Water Conservation Needs as prepared by the Soil Conservation Service, USDA.

(j) Other land - Non-federal rural land not classified as cropland, pasture, forest woodland, or urban and built-up.

(k) CNI noninventory acres - Groups of land uses on which no data other than land use was collected. These groups are (1) federal non-cropland; (2) urban and built-up, and (3) small water areas.

Conservation tillage: Any tillage system specifically used to reduce soil erosion. It may include no-till or chisel plowing, strip tillage and disking when used as a substitute for moldboard plowing.

Contour farming: The practice of performing all tillage and planting operations across the slope or along contour lines of equal elevation. The direction of row crops is around the hillside rather than straight rows which may go up or down the hill.

Conventional tillage method: Includes breaking land with a disk or bottom plow, use of a disk harrow to pulverize the soil after breaking, and a smoothing harrow following the disk harrow and then planting. Weed control is achieved by about two cultivations with a combination of disks, chisels and/or sweeps. Conventional tillage causes greater soil disturbance and less vegetative ground cover than "minimum" and "no-till" methods.

Cost-share: An economic incentive program provided by federal, state, or local governments to encourage certain activities such as the adoption of soil conservation systems. For specific soil conservation practices, land owners are reimbursed for a certain percentage of the cost they incur in adopting the practice.

Crop rotation: A planned sequence of crops growing in a regular recurring succession on the same field. For example, a C-O-M three-year rotation consists of corn the first year, oats the second year and meadow the third year and then the sequence repeats.

Current normal prices: A set of prices for agricultural commodities prepared by the Economic Research Service in accordance with guidelines set forth in the Water Resources Planning Act (PL 89-80) and by the Principles and Standards for Planning Water and Related Land Resources as published in the "Federal Register" September 10, 1973. The current normalized prices provide the price base for evaluating the effect of alternative plans for the development and management of water and related land resources. (See "Agricultural Price Standards" published by the Water Resource Council, October 1974.)

Current normal production: This is the production level of agricultural commodities (for a study area) selected to represent the normal production for a given (or selected) year, after adjustments for the vagaries of weather and other factors which affect production in a particular year. It is intended to be the level of production which would have occurred if rainfall and other factors had been average or normal for that particular year. For planning purposes, it represents the normal level of production for the study area.

Environmental Quality (EQ): A plan consistent with the EQ objective specified as one objective to be considered in water resources study according to Water Resource Council's Principles and Standards in Planning. The objective is to

enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

Feed units: One feed unit is the amount of any livestock feed which is equivalent in food value to one pound of dry, shelled corn. (See Morrisons Feeds and Feeding).

Food and Fiber Production: All agricultural commodities produced for their food value or their fiber value in clothing, building or paper uses.

Forest terminology:

(a) Commercial thinning - Removal through a commercial harvest to improve stocking, species composition, and growing conditions of the remaining stand of timber. A management tool whereby trees that are less desirable or have limited potential can be removed in favoring those trees to be featured in management or to provide opportunities for reproduction of new trees.

(b) Commercial forest land - Land producing or capable of producing 20 cubic feet of industrial wood (more than 20 cubic feet per acre per year) and not withdrawn from timber utilization.

(c) Developed skid trail - A developed or constructed trail or path that is traversed when hauling logs from the bunching area to the log deck; may be created by continuous use of one trail but usually involves some initial shaping, leveling, excavation and subsequent soil disturbance with a crawler-type tractor.

(d) Elm-ash-red maple forest type - Forests in which elm, ash, or red maple, singly or in combination, comprise a plurality of the stocking; common associates include oak.

(e) Fire occurrence rate - A numerical rating representing the number of fires per million acres protected.

$$\text{Rate} = \frac{\text{number of fires}}{\text{acres protected}} \times 1{,}000{,}000$$

(f) Forests - Lands which are: (a) at least 10 percent stocked by forest types of any size and capable of producing timber or other wood products, or capable of exerting an influence on the water regime; (b) lands from which the trees described in (a) have been removed to less than 10 percent stocking and which have not been developed for other uses; and (c) afforested (planted) areas. "Soil bank" lands planted to trees are included here. Lands freshly clear cut and smoothed for cropland or pasture are considered developed for other uses [see (b)] and were reported under the use anticipated.

(g) Seedling sapling - Stands are comprised of live trees of commercial species less than 5 inches in diameter with more than half the stocking being seedling-saplings. Pole timber stands are dominated by live trees of commercial species at least 5.0 inches in diameter but smaller than sawtimber size.

(h) Forest type - A classification of forest land based upon the species forming a plurality of live tree stocking.

(i) Forest tree planting - Planting tree seedlings to establish, reinforce, or improve stocking and/or composition of a forest stand primarily for the production of timber productions.

(j) Growing stock - Live trees that make up the forest, classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees that occupy the forest site.

(k) High Forest Fire Occurrence - Having a range of fire occurrence rates between 283 - 407 (see definition of Fire Occurrence Rate).

(l) Increment - Used to refer to annual growth. Synonymous with net annual growth, mean annual growth or annual change in volume of sound wood.

(m) International ¼-inch rule - A log rule, or formula, for estimating the board-feet volume of logs. The mathematical formula is: $D^2 \times 0.22 - 0.71 \times 0.904762$ for 4-foot sections, where D = diameter inside bark at the small end of the section. This rule is used as the USDA Forest Service Standard Log Rule in the eastern United States.

(n) Inventory - The amount or quantity of forest growing stock.

(o) Loblolly and shortleaf pine forest type - Forests in which loblolly, shortleaf and other southern yellow pines except longleaf or slash pine, singly or in combination, comprise a plurality of the stocking; in the basin area, major species include Eastern redcedar, Virginia pine, and shortleaf pine.

(p) Log haul roads - All forest roads connecting the logging deck with the public highway system, may be engineered or not; most are used for the duration of the timber harvest only.

(q) Maple-beech-birch forest type - Forests in which sugar maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking; in the basin area, there is very little yellow birch; common associates include oak, hickory, yellow poplar, and basswood.

(r) Mechanical site preparation - Preparation of areas to be regenerated to forest trees by use of heavy machinery with or without chemicals. A K-G shearing blade mounted on large size crawler type tractor is most commonly used. Purpose is to deaden or remove existing vegetation and render area suitable to natural reseeding or reforestation by planting or seeding.

(s) Non-commercial thinning - Removal or felling and leaving trees of commercial size that are not marketable. Trees may be non-commercial due to form species, or poor quality. Such trees are often referred to as rough and rotten or cull and wolf trees.

(t) Oak-gum-bottomland forest type - Forests in which tupelo, blackgum, sweetgum, oak, or southern cypress, singly or in combination, comprise a plurality of the stocking and in which pines comprise less than 25 percent of the stocking; common associates include hickory, maple, yellow-poplar, and beech.

(u) Oak-hickory forest type - Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking and in which pines comprise less than 25 percent of the stocking; common associates include hard pine, maple, beech, ash, yellow poplar, blackgum, and elm.

(v) Oak-pine forest type - Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which pines comprise 25 to 50 percent of the stocking.

(w) Pre-commercial thinning and seeding - Elimination by mechanical, hand, chemical or a combination of tools and chemicals of below merchantable size growing stock in overstocked stands. The purpose of this treatment is to achieve more desired stocking of trees that are being featured in management. This practice is most often applicable to overstocked sapling stands that have a considerable number of stems in excess of what the site will support in terms of optimal production. If not accomplished, timber stands can become significantly stagnated with only minimal annual growth, delays in stand achieving merchantable size and growing stock never reaching its potential in terms of size and quality.

(x) Poletimber stands - Acreages of timber dominated by live trees of commercial species at least 5.0 inches in diameter but smaller than sawtimber size.

(w) Release - Elimination by mechanical or chemical means of unmerchantable trees that are inhibiting the development of desired growing stock by competing for sunlight, moisture and nutrients. Most applicable to large trees of poor form (or rotten) that are dominant in the forest canopy. Through release more desirable trees that are being overtopped and suppressed are rendered free to grow. Treatment sometimes referred to as weeding and may include the elimination of vines, shrubs or other vegetation in competing with and deterring growth of desired trees.

(z) Reforestation - Re-establishment of a tree crop on forest land. Silvicultural treatments such as seeding, planting, and various types of site preparation may be involved or the process may occur completely naturally.

(a1) Sawtimber - Trees fit to yield sawlogs. Trees usually must be a minimum of 11 inches in diameter at breast height (approximately 4½ feet above ground level) for hardwood and 9 inches in diameter for softwood.

(a2) Sawtimber stands - Acreages of timber dominated by live trees of commercial species with a diameter of 9 inches or greater for softwood species and 11 inches or greater for hardwood species.

(a3) Seedling-sapling stands - Acreages of timber comprised of live trees of commercial species less than 5 inches in diameter with more than half the stocking being seedling-saplings.

(a4) Silviculture - The science and art of growing and tending forest crops. More particularly, the practices and treatments of controlling the establishment, composition, development and growth of forests.

(a5) Skid trail - A path traversed by a machine and/or animal in the course of sliding logs or trees from stump to a developed skid trail or log decking site. Distinguished from developed skid trail in that no construction or excavation is involved.

(a6) Timber stand improvement (TSI) - A commonly used term referring to a variety of silvicultural treatments performed in existing stands of timber. Some TSI practices include release and weeding, non-commercial thinning and pre-commercial thinning.

(a7) Very high forest fire occurrence - Having a range of fire occurrence of 408 and more (see definition of Fire Occurrence Rate).

(a8) White and red pine forest type - Forests in which eastern white pine, red pine, or hemlock, singly or in combination, comprise a plurality of the stocking; in Kentucky this major type has only one local type hemlock; common associates include hard pine, oak, maple, and yellow poplar.

Grassed waterway: A constructed outlet shaped, graded and established with permanent vegetation for safe disposal of runoff. Their purpose is to provide an outlet for runoff and prevent gully formation.

Gross erosion: Refers to the total amount of soil removed from an area through the action of wind or rainfall. It is used primarily in reference to soil loss on agricultural land.

Gully erosion: A type of erosion characterized by gully like trenches where the soil has worn away.

Land Capability Unit (LCU): A grouping of soils that are suited for similar crops and cultural practices and which require similar systems of management for these crops.

Land Resource Area (LRA): A geographical region following county boundary, within which are similar soils, climate, geology, vegetation and agricultural development.

Linear Programming (LP) Model: A mathematical, computerized procedure for determining the optimum production pattern for a set of products, given a set of resource constraints and costs for various methods of production.

Minimum tillage methods: As compared to conventional tillage methods, minimum tillage methods reduce the disturbance of the soil during land preparation and crop cultivation. It may use a chisel plow rather than a bottom plow in land preparation. It may also use one mechanical cultivation for weed control rather

than two or it may use a combination of mechanical (plowing) means and herbicides to control weeds. This method is sometimes referred to as "reduced tillage" or "conservation tillage."

Moldboard plowing: A tillage technique which inverts the top four to twelve inches of soil. The technique incorporates all surface residues into the soil profile and exposes bare soil.

National Economic Development (NED): A plan consistent with the NED objective specified as one objective to be considered in Water Resource Council's Principles and Standards for Planning. The objective of NED is to enhance national economic development by increasing the value of the Nation's output of goods and services and improving national economic efficiency.

No-till method: As compared to conventional and minimum tillage, no-till is a practice of planting corn, soybeans, etc. without disturbing the soil except where the seed is actually placed. A herbicide is used to control any plant competing with the planted crop. Sod planters, designed especially for no-till planting, are used to incorporate the seed in the soil.

OBERS Projections (Series C, E, E^1): A nationally consistent set of projections produced by the joint efforts of the Bureau of Economic Analysis (BEA), U.S. Department of Commerce, formerly called Office of Business Economics (OBE), and the Economic Research Service (ERS), U.S. Department of Agriculture. The ERS responsibility is for projecting agricultural commodities consistent with different Bureau of Census population projections. The Series C and E refer to different birth rate assumptions with E the lower of the two. The E^1 series is the agricultural production assumed necessary under Series E birth rate and a revised higher export assumption.

Plan Element: A technical measure instituted in order to assist in implementation of the alternative course of action.

Plan Formulation: The stage of planning after much data has already been collected and analyzed and the planning participants begin to specify and describe in detail the projects (or plan components) that will be useful in solving problems and in meeting the planning objectives. Several different plans (combinations of projects and/or components) may be assembled and evaluated during the plan formulation stage in order to select the most desirable plan.

Prime farmland: Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, and acceptable acidity or alkalinity.

Planning subarea: A subpart of the overall study area for which data is tabulated and analyzed separately.

Rill erosion: The removal of soil by runoff which causes small but well-defined channels. If these channels do not interfere with normal tillage, these channels are called rills.

Runoff: That part of rainfall which flows over the ground surface and through channels to larger streams.

Sedimentation: The process of sediment accumulating at a point downstream from where the erosion occurs.

Sheet erosion: The removal of a fairly uniform layer of soil from the land surface by sheet runoff water.

Soil Resource Group: A group of homogeneous land capability units. Soils are combined in this manner to reduce the size and cost of the linear programming model.

Strip cropping: Growing crops in a systematic arrangement of strips or bands to reduce soil erosion. The crops are arranged along a slope so that strips of soil conserving crops alternate with strips of row crops.

T-value erosion limits: The gross erosion (in tons) which soil scientists believe can be lost annually without eventually diminishing the productivity of the soil. The t-value varies depending upon the individual soil characteristics.

Universal soil loss equation: A computational formula to determine the amount of soil movement on an acre of land. It contains variables relating rainfall, soil erodability, management, physical practices and slope characteristics.

Water Resource Council: Authorized by PL 89-80 on July 22, 1965, to encourage the conservation, development and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal Government, States, localities and private enterprise. The council participants are the Secretaries of the U.S. Department of Interior; Agriculture; Army; Health, Education, and Welfare; and Transportation; and the Federal Power Commission.

Water Resource Subarea (WRSA): The county boundary approximations of the hydrologically defined water resource subregions. The subregions are the tributary and main stem reaches of the twenty water resource regions which correspond to the major drainage pattern of the United States.

UNITED STATES DEPARTMENT OF AGRICULTURE

Economics and Statistics Service
Forest Service
Soil Conservation Service

KENTUCKY SOIL AND WATER CONSERVATION COMMISSION
KENTUCKY DEPARTMENT FOR NATURAL RESOURCES
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